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PREFACE TO FIFTH EDITION.

The present edition of my Quiz-Compend is founded on the last revision of Remington's "Pharmacy," which, in turn, is founded on the revision of the Pharmacopœia of 1890. Part Second has been entirely rewritten and reclassified, and much of it put into tabular form. Many of the tables are modifications of those furnished on the same subjects in Coblentz's "Pharmacy." However, several of them are original, and all are especially adapted for the use of the student. Part Third has been thoroughly revised to correspond with the U. S. P., and the work of the entire Compend has been verified by Charles Milton Buchanan, M.D., Professor of Chemistry, Toxicology, and Metallurgy, National University, Washington, D. C., thus making it one of the most correct publications of the kind ever issued. I have retained the tables for transposing the English and Metric Systems of Weights and Measures furnished by the United States Geodetic and Coast Survey, which the Department kindly permitted me to use in the last edition. These tables have been found of great practical value, and are very useful to students and for reference generally.

F. E. STEWART.

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PREFACE TO FIRST EDITION.

The collection of substances employed in medicine is called MATERIA MEDICA: the substances themselves are known as drugs. PHARMACY is the science of preparing these substances; THERAPY is the science of applying them to the treatment of the sick. These three branches are properly classified under the general head PHARMACOLOGY, or the SCIENCE OF DRUGS.

To prepare drugs properly, a knowledge of their properties is necessary. The pharmacist must have a knowledge of their physical properties to identify them, of their chemical properties to select the proper menstruums for extracting their medicinal virtues, and a knowledge of their therapeutical properties to prepare them in the best manner to meet the indications of a rational therapeutics. The neglect of this latter branch on the part of the pharmacist has too often resulted in a sacrifice of therapeutic efficacy to obtain pharmaceutical elegance. The former is the principal object to aim for, though the latter is very important, for it is apparent that the most elegant pharmaceutical preparation, if it have not therapeutic value, is worse than useless.

The importance of studying these three branches together will, therefore, be appreciated. Works on pharmacy recognize this importance to a greater or less degree, and embrace, in proportion as the author views the subject from this point of view, a comprehensive Pharmacology. Though, in the opinion of the author, no work has yet been written that brings therapy and modern pharmacy close enough together, it is not his object in the following pages to make the attempt.

It is not the object of a QUIZ-COMPEND to teach new facts. It is its object, rather, to present facts already well known to science in a form easy to comprehend, for the purpose of aiding the student in memorizing them. And as the immediate end which the student is seeking to attain is the passing of his examination in a creditable manner—this end has been carefully considered by the author in writing the following pages.

Quizzes are reviews and explanations of the teachings of others. It is the purpose of the author to observe this rule; and in so doing he has followed, in the main, the leadership of his esteemed friend and teacher, Professor Joseph P. Remington, of the Philadelphia College of Pharmacy, whose excellent work in the Committee for the Revision of the United States Pharmacopœia, and on the United States Dispensatory, and more recently displayed in his masterly treatise, "The Practice of Pharmacy," justly entitle him to the great reputation which he has acquired as one of the greatest of modern teachers in the branch of knowledge under consideration.

Finally, it must be remembered that a QUIZ-COMPEND is not a *text-book.* It is intended for the sole purpose of aiding the student in connection with his lecturer and text-book, and will not do as a substitute for either.

F. E. STEWART.

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COMPEND OF PHARMACY.

INTRODUCTORY.

PHARMACOPŒIAS AND DISPENSATORIES.

What is a Pharmacopœia? A Pharmacopœia is an authoritative list of medicinal substances, with definitions, descriptions, or formulæ for their preparation.

The necessity for authoritative standards to define the character, establish the purity, and regulate the strength of medicines, is recognized by all civilized nations. The most important of these works, with the date of their last issue now extant, are as follows: U. S. Pharmacopœia (1893);[1] British Pharmacopœia (1885);[2] Pharmacopœa Germanica (1890); Codex Medicamentarius (Pharmacopée Française)—France (1884); P. Austriaca—Austria (1889); P. Rossica—Russia (1891); P. Suecica—Sweden (1869); P. Norvegica—Norway (1879); P. Danica—Denmark (1893); P. Belgica—Belgium (1885); P. Helvetica—Switzerland (1893); Farmacopea Española—Spain (1884); Pharmacopêa Portugueza—Portugal (1876); P. of India (1868);[3] P. Hungarica—Hungary (1888); P. Neerlandica—Netherlands (1889); P. Româna—Roumania (1874); P. Fenica—Finland (1885); ΕΛΛΗΝΙΚΗ ΦΑΡΜΑΚΟΠΟΙΙΑ—Greece (1868); Nueva Farmacopea Mexicana (1884); Farmacopea ufficiale del Regno d'Italia—Italy (1892); Farmacopea Chilena—Chili (1886); Pharmacopœa Japanica—Japan (1891).

Countries having no national Pharmacopœia adopt the standard of other countries, or supply standard pharmaceutical works for the same purposes.

The Pharmacopœias of all nations except those of the United States, Mexico, Chili and Greece, are issued under the authority of the respective governments, and therefore partake of the nature of laws.

The U. S. P. was originally devised, and is decennially revised, by a committee appointed from the professions of medicine and pharmacy. It should be a representative list of the drugs and preparations employed in therapeutics.

NOMENCLATURE OF THE UNITED STATES PHARMACOPŒIA OF 1890.

How are the titles of the medicinal substances indicated in the U. S. P. of 1890? 1, by the Official Name, which is always in Latin; 2, by the English Name; 3, by the Synonym; 4, by the Botanical Name

---

[1] Designated as "U. S. P., 1890."

[2] Supplement, 1890.

[3] Supplement, 1869.

(in the case of plants); 5, by the Symbolic Formula (in the case of chemicals).

Give examples of each. Cannabis Indica (official name). Indian Cannabis (English name). Indian Hemp (Synonym). Zinci Iodidum (O. N.). Zinc Iodide (E. N.). ZnI_2; 318.16 (Symbolic Formula). Prunus Virginiana (O. N.). Wild Cherry (E. N.). Prunus serotina (Botanical name).

1. The Official Name.—When is the use of the official name proper? In designating the drug when precision is required—labels, prescriptions, specimens, etc.

Why is the Latin Language employed for the official name? Because it is a dead language and is not liable to change, as in the case of a living tongue.

2. The English Name.—When should the English name be employed? In ordinary conversation, in commercial transactions, and in all cases "where the use of the Latin official name could be justly criticised as an ostentatious display of erudition."

3. The Synonym.—When should the synonym be used? The synonym should be rarely or never used. The synonym is usually antiquated and from an unscientific source, but on account of long usage in common language synonyms cannot be completely ignored.

4. The Botanical Name.—What is meant by the botanical name? "By this is meant the systematic name recognized by botanists for plants, which serves in pharmacopœial nomenclature as the basis of the official name."

Capsicum fastigiatum is the botanical name for the variety of Cayenne pepper designated by the U. S. P. Capsicum indicates the genus, fastigiatum the species to which the plant belongs. Then follows the definition, which shows what part of the plant is employed, "the *fruit* of Capsicum fastigiatum."

When should a capital letter be employed in writing the specific name? 1. When the specific name is derived from a generic name, as *Rhamnus Frangula;* 2. When derived from the name of a person, as *Strychnos Ignatii;* 3. When indeclinable, as *Erythroxylon Coca.*

The name of the author follows the botanical name, as *Capsicum fastigiatum* Blume, then the natural order to which the plant belongs, in italics, the latter being enclosed in parentheses, as (Nat. Ord., *Solanaceæ*).

When should the botanical name be employed? Its use is absolutely necessary in establishing the identity of drugs.

5. The Symbolic Formula.—What is meant by the symbolic formula? The symbolic formula is a combination of symbols representing the chemical structure of the articles to which they refer, with the utmost brevity and exactness.

NaI means the same as Sodii Iodidum and Iodide of Sodium, but it is shorter and much more definite. $(ZnCO_3)_2 3Zn(HO)_2$ means that precipitated carbonate of zinc consists of two molecules of carbonate of zinc and three molecules of hydrate of zinc. $Na_2SO_3 + 7H_2O$, means sulphite of sodium containing seven molecules of water of crystallization, and no other sulphite of sodium.

Both the new and the old chemical nomenclature are used by the U.S.P.

in expressing symbolic formulæ—the latter in italics—but the former is to be preferred.

The figures following the symbolic formulæ express the molecular weight (the sum of the weights of the atoms) of the chemical. For example, the molecular weight of $Na_2SO_3 + 7H_2O$ is 252. Na weighs 23; two atoms are employed, which equals 46. S weighs 32. O weighs 16; three atoms are employed, which equals 48. H weighs 1; two atoms are employed, which equals 2. O weighs 16, which added to 2 equals 18. H_2O is taken 7 times; 7 times 18 equals 126. $46 + 32 + 48 + 126 = 252$, the molecular weight of sulphite of sodium.

This matter of atomic and molecular weights can be made clear to the student by the following illustration: A pays B 100 sovereigns, English money, in sovereigns and half sovereigns, giving him 50 of the former and 100 of the latter; how much will the 100 sovereigns of gold weigh?

1 sovereign weighs 124 grains × 50 = 6200 grains.
½ " " 62 " × 100 = 6200 "

Weight of 100 sovereigns in gold, 12400 grains.

In the same way the molecular weight of water (H_2O) is 18.

H, Hydrogen atom, weighs $1 \times 2 = 2$
O, Oxygen atom, " $16 \times 1 = 16$

Molecular weight of H_2O, 18

Official Description.—Immediately following the official definition, there will be noticed in the Pharmacopœia, in smaller types, what is termed the official description: of what does this description usually consist? (A) In drugs—1, a concise statement of physical characteristics; 2, tests of identity; 3, description of adulterants. (B) In chemicals—1, statement of physical characteristics, as in case of drugs; 2, solubilities; 3, tests of identity and purity.

DISPENSATORIES.

What is a Dispensatory? A Dispensatory is a Commentary on a Pharmacopœia.

What do Dispensatories aim to present? The Dispensatories generally aim to present information concerning important non-official drugs and those official in other Pharmacopœias, as well as those of the U. S. P.

What Dispensatories have we in the U. S.? We have in this country The United States Dispensatory, National Dispensatory, and King's Dispensatory.

PART I.

METROLOGY.

WEIGHT, MEASURE, AND SPECIFIC GRAVITY.

What is weight? Weight is the difference between the attraction of the earth and that of surrounding bodies for bodies on the surface of the earth.

Upon what does the weight of a body depend? Upon its bulk and density. Density is the amount of matter in given bulks of bodies.

What is meant by weighing? Balancing a body of known gravitating force with one whose gravity is not known, for the purpose of estimating the gravitating force of the latter, which is called its weight.

What are weights? Bodies of known gravitating force used for weighing.

What name is given to the apparatus used for weighing? Scales and weights.

What standards are used upon which to base the system of weights? The Grain and the Metre.

How was the grain weight derived? By act of Henry III of England, in 1226; "An English silver penny, called the sterling, round and without clipping, shall weigh *thirty-two grains of wheat*, well dried and gathered out of the middle of the ear."

What is a Metre? One 40 millionth of the circumference of the earth at its poles.

What systems of weights used in Pharmacy are based on the Grain? The Troy or Apothecaries' system and the Avoirdupois system.

State the denominations of each. *Troy or Apothecaries' Weight:* 20 grains = 1 scruple; 3 scruples = 1 drachm; 8 drachms = 1 ounce; 12 ounces = 1 pound. *Avoirdupois Weight:* 437½ grains = 1 ounce; 16 ounces = 1 pound.

State the Symbols of each. *Troy:* grain, or grains, gr.; scruple, ℈; drachm, ʒ; ounce, ℥. *Avoirdupois:* ounce, oz; pound, ℔.

How many grains does the ounce of each system contain, respectively, and what is the difference in grains between the Troy and Avoirdupois ounce? Avoirdupois ounce = 437½ gr.; Troy ounce = 480 gr. Troy ounce 42½ grains greater.

What is the difference in grains between the Avoirdupois and Troy pound? Avoirdupois pound, 7000 gr.; Troy pound, 5760. Avoirdupois pound, 1240 grains greater.

What is Measure? The bulk or extension of bodies.

What Systems of Measure are used in Pharmacy? Apothecaries' or Wine Measure, Imperial or British Measure, and the Metric System.

State the denominations of each. *Apothecaries' Measure:* 60 minims = 1 fluidrachm; 8 fluidrachms = 1 fluidounce; 16 fluidounces = 1 pint; 8 pints = 1 gallon. *Imperial Measure:* 60 Imperial minims = 1 Imperial fluidrachm; 8 Imperial fluidrachms = 1 Imperial fluidounce; 20 Imperial fluidounces = 1 Imperial pint; 8 Imperial pints = 1 Imperial gallon.

NOTE.—The U. S. Fluidounce is equal to 480 U. S. minims, and to 500 Imperial minims. The Standard Imperial gallon is the volume of 70,000 grains, or 10 avoirdupois pounds of pure water at + 62° F., barometer at 30 inches. One Imperial minim of pure water at + 62° F., only weighs 0.911458 grain.

State the Symbols of each. *Apothecaries' Measure:* Minim, ♏; fluidrachm, fʒ; fluidounce, f℥; pint, O; gallon, Cong. *Imperial Measure:* Minim, min.; fluidrachm, fl. dr.; fluidounce, fl. oz.; pint, O; gallon, C.

State the relations of Apothecaries' and Imperial Measures to Troy and Avoirdupois Weights. *Apothecaries' Measure:* The pint of distilled water at 15.6° C. (60° F.) weighs 7291.2 gr.; the fluidounce, 455.7 gr.; the gallon, 8.3328 pounds avoirdupois. *Imperial Measure:* pint weighs 8750 gr.; fluidounce, 437.5 (which is the same as the avoirdupois ounce, and 18.2 gr. less than that of the U. S. fluidounce of water at the same temperature); gallon, 10 pounds avoirdupois.

What is a Metre? The unit of length of the Metric, French, or Decimal system, from which all other denominations are derived.

How was it obtained? It was obtained by a measurement of the quadrant of a meridian of the earth, and is about $\frac{1}{40000000}$ of the circumference of the earth at the poles.

What is it practically? Practically, it is the length of certain carefully preserved bars of metal from which copies have been taken.[1]

What is its equivalent in feet and inches? It is equal to about 3 ft. 3 in. and 3/8 in.

What is the unit of surface, and how derived? The unit of surface is the Are, which is the square of ten metres (the square of a dekametre) = a square whose side is 11 yards.

What is the unit of capacity, and how derived? The *Litre*, which is a cube of a tenth of a metre (the cube of a decimetre) = 2.1134 pints.

What is the unit of weight, and how obtained? The unit of weight is the *Gramme*, which is the weight of that quantity of distilled water, at its maximum density (4° C.) which fills the cube of the one-hundredth part of the metre (cube of a centimetre, or, in other words, cubic centimetre, C.c.) = 15.43235 grains, or about 15½ grains.

How are the denominations of the Metric System multiplied and divided? They are multiplied by the Greek words, "Deka," Ten; "Hecto," Hundred; "Kilo," Thousand; and divided by the Latin words, "Deci," one-tenth; "Centi," one-hundredth; "Milli," one-thousandth.

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[1] Accurate models or prototypes have been made of the principal units of linear measure, measures of capacity, and weights. These actual standards are usually legalized, are carefully preserved in the custody of governments, and serve as originals, of which copies are taken directly or indirectly for actual use.

TABLE SHOWING HOW METRIC UNITS ARE MULTIPLIED AND DIVIDED

Quantities.	Length.	Surface.	Capacity.	Weight.
1000	Kilo-metre.	. . . .	Kilo-litre.	Kilo-gramme.
100	Hecto-metre.	Hectare.	Hecto-litre.	Hecto-gramme.
10	Deka-metre.	. . . .	Deka-litre.	Deka-gramme.
1 (Units.)	METRE.	ARE	LITRE.	GRAMME.
.1	Deci-metre.	. . .	Deci-litre.	Deci-gramme.
.01	Centi-metre.	Centare.	Centi-litre.	Centi-gramme.
.001	Milli-metre.	. . . .	Milli-litre.	Milli-gramme.

—(Attfield.)

Describe the use of the Gramme and Cubic Centimetre (fluigramme) as units of weight and measure. In the practical working of a laboratory, the gramme and its divisions are used for weighing, and the cubic centimetre (C.c. or fluigramme) for measuring liquids. A gramme and a cubic centimetre of distilled water are identical, but owing to greater or less density, cubic centimetres of other liquids weigh more or less than a gramme. But if the C.c. is taken as a unit of capacity only, and the gramme as the unit of weight, all difficulty is avoided. For example, dissolve 1 gramme of sugar in sufficient quantity of water to make 10 C.c. It is evident that each C.c. of this solution contains 1 decigramme of sugar. By keeping the C.c. intact and varying the strength of the solution, each C.c. can be made to contain any stated amount of sugar from saturation to infinity.

TABLE OF EQUIVALENTS.

One Cubic Centimetre, ... = 16.23 Minims.
Four " " . . . . . = 1.08 Fluidrachms.
Thirty " " . . . . . = 1.01 Fluidounces.
One Minim, ... = 0.06 C.c.
Four " . . . . = .25 "
Ten " . . . . = .62 "

One Troy drachm, ... = 3.888 Grammes.
One Troy ounce, ... = 31.103 "
One Avoirdupois ounce, ... = 28.35 "

Explain the signification of the Micromillimetre and the Kilo. Micromillimetre (Mkm) is a term used in microscopy, and signifies the one-thousandth part of a millimetre. Kilo is merely an abbreviation of the word kilogramme, and is used for convenience and brevity.

How would you convert metric weights or measures into those in ordinary use? Multiply the metric quantities by the corresponding equivalent. Ex. To convert—

Metres into inches, ...	multiply	by	39.370
Litres into fluidounces, ...	"	"	33.815
Cubic Centimetres into fluidounces, .	"	"	0.0338
" " " Imperial fluidounces	"	"	0.0352
Grammes into grains, ...	"	"	15.432
Decigrammes into grains, ...	"	"	1.5432
Centigrammes " "	"	"	.15432
Milligrammes " "	"	"	.015432

How would you convert the weights and measures in ordinary use into metric weights and measures? Multiply the quantities by the corresponding metric equivalent. Ex. To convert—

Inches into metres, ...	multiply by	0.0254
Fluidounces into cubic centimetres,	" "	29.572
Grains into grammes, ...	" "	0.0648
Avoid. ounces into grammes, . .	" "	28.3495
Troy " " " . .	" "	31.1035

What is a Balance? An instrument for determining the relative weight of substances.

How many kinds of Balances are there? Five: 1. Single beam, equal arm. 2. Single beam, unequal arm. 3. Double beam, unequal arm. 4. Compound lever balances. 5. Torsion balances.

Describe the construction, requirements, and tests of each. 1. SINGLE BEAM, Equal Arm.—*Construction.*—A beam is suspended on a knife-edge, which divides it into equal arms; end knife edges are placed at each end of the beam, on the same plane and at equal distances from the point of suspension, for supporting the pans which carry the substances to be weighed.

Requirements.—1. "When the beam is in a horizontal position, the centre of gravity should be slightly below the point of suspension, or central knife-edge, and perpendicular to it." 2. "The end knife-edges must be exactly equal distances from the central knife-edge; they must all be in the same plane, and the edges absolutely parallel to each other." 3. "The beam should be inflexible, but as light in weight as possible, and the knife-edges in fine balances should bear upon the agate planes."

Test.—1. Sensibility with unloaded pans: 1. Place the balance in position on a perfectly level counter or table; elevate the beam so that it is free to oscillate; when the balance comes to rest, place the smallest weight to which it is sensitive upon the right-hand pan, to which the balance should immediately respond. 2. Sensibility with loaded pans: Place the full weight the balance is designed to carry on the pans, then on one pan place the smallest weight, as before. The balance should respond in a decided manner. 3. Equality of arms: Load the pans to half their capacity, perfecting the equilibrium, if necessary, with a piece of tin-foil. Now reverse the weights, and if the equilibrium is still maintained, the arms of the beam are equal. 4. Parallelism in knife-edges: Moderately load and balance the pans. Now shift one of the larger weights in different positions on the edge of the pan, carefully noting any variation in equilibrium, if such occur. This variation indicates a want of parallelism in the knife-edges.

2. SINGLE BEAM, Unequal Arm.—*Construction.*—This can be seen by inspecting the well known Fairbanks scales. It depends on the principle in physics, "The *power is to the weight or resistance in the inverse ratio of the arms of the lever.*" The longer arm of the beam is graduated for a movable weight, the use of which dispenses with small weights, which is a decided advantage.

3. DOUBLE BEAM, Unequal Arm.—*Construction.*—Same as the above,

but with two parallel beams. Employed for weighing liquids, etc., the outside beam being used to tare the bottle or jar.

4. COMPOUND LEVER BALANCES.—Well shown in Fairbanks' platform scales, used for druggists' counters and sometimes for prescription scales. Trömner has an excellent scale for weighing liquids on this principle.

5. TORSION BALANCES.—A compound beam is balanced and supported upon an immovable centre frame, upon which a flattened gold wire is stretched with powerful tension; the beam is prevented from slipping out of place, and the torsion is secured, by the gold wire being firmly fastened to the under side of the beam; upon the ends of the beam are fastened the movable frames which support the pans. There is a simple method of arresting the motion by moving the lever, and the delicacy of the balance is increased by placing a weight upon the index, whereby the centre of gravity is elevated. *Knife-edges are done away with entirely.*

How may Balances be protected? By enclosing them in glass cases with convenient sliding doors.

How are liquids measured? In graduated vessels; vessels of tinned copper, tinned iron, and enameled sheet iron, called agate, are usually employed for quantities larger than one pint; but glass measures are preferable for quantities of one pint or less. The former are generally made larger at the bottom than at the top; the latter are either conical, with apex at the bottom, or cylindrical, and graduated on the sides. It is better that the marking be on both sides of the graduate.

How would you test a glass graduate? Place it upon a perfectly level surface, then pour into it 455.7 grains distilled water at 15.6° C. (60° F.). This should measure one fluidounce; or, measure into the graduate 30 C.c. of water (29.57 C.c.) for a fluidounce.

What is a graduated Pipette? A glass tube graduated on the side, with a constricted point. It is used by applying suction to the upper end, and holding the liquid in the tube by placing the finger on the upper end while reading off the contents.

What is a Meniscus, and for what is it used? Owing to capillary attraction, the top of the liquid in a graduated pipette presents a cup shape. This is called a *meniscus.* A line drawn through the bottom of the *meniscus* is usually selected as the reading point.

What is the size of a drop? Erroneously, a drop is supposed to be a minim; but though this may be approximately true when applied to water, it is not true in regard to any other liquid. Thick, viscous liquids produce large drops; heavy, mobile liquids small ones. A drop of syrup of acacia is five times as large as a drop of chloroform. The shape and surface from which the drop is poured also influences its size.

SPECIFIC GRAVITY.

What is Specific Gravity? The comparative weight of bodies of equal bulk. It is ascertained by weighing the bodies with an equal bulk of pure water at a given temperature and atmospheric pressure, which is taken as one.

How would you obtain the Specific Gravity of a body? To obtain the specific gravity of a body, it is only necessary to balance it with an equal bulk of the standard, and ascertain how many times the weight of the standard is contained in its weight. Ex. A fluidounce of water (standard) weighs 455.7 grains; a fluidounce of lime-water weighs 456.3 grains; 456.3 ÷ 455.7 = 1.0015, that is, the lime-water weighs 1.0015 times more than water, bulk for bulk. In other words, its specific gravity is 1.0015. A fluidounce of alcohol weighs 422.8; 422.8 ÷ 445.7 = 0.928, specific gravity.

What general rule may be given for finding Specific Gravity? Divide the weight of the body by the weight of an equal bulk of water; the quotient will be the specific gravity.

What method is usually adopted to ascertain the weight of the equal bulk of water in taking the Specific Gravity of solids? A solid body immersed in water will displace its own bulk; it is required to find out the weight of this equal bulk of water. This might be ascertained by immersing the body in a vessel of water already full, then saving and weighing the displaced water which runs over. But there is a better way of finding out. Archimedes filled his bath-tub too full of water, one day, and it overflowed when he got into it. This led him to experiment, and he found that when weighed in water he lost as much weight as the water he displaced weighed. It is only necessary, then, to weigh a body first in air, then in water, and note its loss of weight when weighed in the latter medium. This loss is evidently the weight of an equal bulk of water. By our rule, we divide the weight of the body by the weight of an equal bulk of water; and it follows that it is the same thing to say: divide the weight of the body by its loss of weight in water, for that loss is the weight of an equal bulk of water. The quotient will be the specific gravity.

How would you take the Specific Gravity of a body heavier than water? Four methods are used. *1st method:* Accurately weigh the substance and note the weight. Now suspend the body from the hook at the end of the scale-beam with a horse-hair, so it shall hang a little above the scale-pan; next, place a small wooden bench in such a manner that it shall straddle the scale-pan, but not touch it; place a small beaker on the bench, partly filled with water, in which submerge the suspended body, noting the loss of weight by the use of proper weights on the opposite scale-pan; after which apply the rule already given. Ex. Weight of a piece of copper in the air, 805.5 grains; weight in water, 715.5 grains; loss of weight, 90 grains. 805.5 ÷ 90 = 8.95, sp. gr. *2d. method:* With the specific gravity bottle. Add 1000 to the weight of the substance in the air. Now drop it into a 1000-grain specific gravity bottle, fill the bottle with water and weigh again. Subtract the 2d sum from the 1st sum, and the difference is the loss of weight in water. Now apply the rule. Ex. A piece of aluminum wire weighs 100 grains in the air. 100 + 1000 = 1100. Dropped in a 1000-grain specific gravity bottle, and the bottle filled with water, the weight of both is 1062. Then 1100 — 1062 = 38 grains, the loss of weight in water. 100 ÷ 38 = 2.63, specific gravity. *3d method:* With the graduated tube. Drop the substance into a tube graduated so that each space shall indicate a grain or gramme of water, and note how much higher the liquid rises in the tube, which is the weight of an equal bulk of the substance. This known, apply the rule. *4th method:* By immersing the solid in a transparent liquid of the same density. Drop the solid in a liquid of sufficient density to float it, then reduce its density with water until the solid neither rises nor sinks, but swims indifferently. The specific gravity of the liquid and solid will now be the same. Take out the solid and find the specific gravity of the liquid with the specific gravity bottle.

How would you proceed if the solid were soluble in water? Use oil or some other liquid in which the solid is not soluble, as though it were water, then, by the following proportion, find the loss of weight in water; as the specific gravity of oil is to the specific gravity of water, so is the loss of weight in oil to the loss of weight in water. Then apply the rule.

How would you take the Specific Gravity of a solid lighter than water? Force the substance under water by attaching a heavier body to it. First weigh both in the air, then both in water, and the difference will be the loss of both in water. A simple subtraction will give the loss of weight of one. Then apply the rule.

With what apparatus would you take the Specific Gravity of a liquid? A specific gravity bottle, hydrometer, or specific gravity beads.

How would you construct a Specific Gravity bottle? A bottle with a long, slim neck is counterpoised by an appropriate weight, and distilled water at the appropriate temperature, 15° C. (60° F.) poured in until it contains 1000 grains. The height reached by the water in the neck is then scratched thereon with a file, and it is ready for use.

What are the Specific Gravity beads? Little pear-shaped, hollow globes of glass, loaded at the apex, and arranged to float indifferently in liquids of the specific gravity for which they are gauged, but to sink or swim in liquids that are lighter or heavier than they are.

Give directions for using the Specific Gravity bottle for taking the Specific Gravity of Liquids. Counterpoise the bottle and fill it to the mark with the liquid to be examined. The number of grains the liquid weighs, properly pointed off decimally, is its specific gravity. A 1000–gr. specific gravity bottle will hold 1160 grains of hydrochloric acid. Point off decimally 1.160, which is the specific gravity of hydrochloric acid. A 1000–gr. specific gravity bottle will hold 750 grains of ether. Point off decimally 0.750, thus showing the relation to the specific gravity of water, 1.

If a bottle of any size is substituted for the 1000-gr. bottle, what equation will give the specific gravity? As the number of grains of water the bottle holds is to 1000 (the specific gravity of water), so is the number of grains of liquid it holds, to the specific gravity of the liquid.

Describe the Hydrometer. As now constructed, the hydrometer usually "consists of a glass tube loaded at the bottom with mercury or small shot, having a bulb blown in it just above the loaded end." The principle of its action depends upon the fact that a solid body floating in a liquid displaces a volume of liquid exactly equal to its own weight.

Into what two general classes may Hydrometers be divided? 1st, those for liquids heavier than water; 2d, those for liquids lighter than water. The first class are called by the French *Pèse-Acide*, or *Pèse-Sirop*, and the second class *Pèse-Esprit*.

What other class of Hydrometers is in use? Those intended to sink, by the addition of weights, to a given mark on the stem, and thus displace a constant volume.

What is a Baumé Hydrometer? The instrument devised by Baumé is peculiar only in so far as its system of graduation is concerned. This was made in the following manner: *1st, for liquids heavier than water,* the instrument was loaded with sufficient mercury to sink it in water to a convenient point near the top, which was marked 0. It was then placed in a 15 per cent. salt solution, and the point at which it rested marked 15; the interspace between 0 and 15 was now marked off into 15 equal spaces, and the scale below extended by marking off similar spaces. *2d, for liquids lighter than water,* a 10 per cent. salt solution was used, and the instrument loaded to sink into it to a point just above the bulb, which was marked 0. It was then allowed to sink in water, and the point of rest marked 10. The interspace between 0 and 10 was now divided into 10 equal spaces, and the scale above extended by marking off equal spaces.

What is the objection to Baumé's Hydrometer? The graduations are entirely arbitrary, necessitating computation to determine the corresponding specific gravity.

What Hydrometer is rapidly taking its place? The Specific Gravity Hydrometer; the graduations upon the stem indicating at once the specific gravity.

Urinometer, *saccharometer*, elæometer (for fixed oils), and alcoholometer, and hydrometers for the special purposes indicated by their names.

HEAT.

What is heat? Heat is molecular motion.

What is a Furnace? A species of stove for generating heat.

What are the elements of a furnace? The *air-flue*, *combustion-chamber*, and *vent* or *chimney*.

What proportion should they bear to each other? The special object sought in constructing the furnace must determine the proportions these shall bear to each other.

What is the best fuel for generating heat? Anthracite Coal.

How much air is required to burn one pound of coal? Theoretically, 150 cubic feet; practically, twice that.

What liquids are used for fuel in pharmacy, and on what does their heating power depend? Alcohol, petroleum or coal oil, and benzin or gasolene. They all contain C and H (alcohol, 34 per cent. O in addition), on which their heating depends.*

What is Illuminating Gas? A mixture of carburetted hydrogen (CH_4), which is its principal constituent, with considerable hydrocarbons, hydrogen, carbon dioxide and monoxide, aqueous vapors, and traces of oxygen and nitrogen.

How may it be fitted for heating purposes? By mixing it with air.

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*For special apparatus for developing heat for pharmaceutical manipulations, see Remington's "Practice of Pharmacy."

This is done by admitting air below the flame, using special apparatus for this purpose.

Describe a Bunsen Burner. A brass tube, four inches high, with four large circular holes near the base, to admit the air, which may be regulated by a perforated brass ring which surrounds the tube, is supported by a metal pedestal, and connected with a gas fixture by a tube. The coal-gas admitted mixes with the air, and burns at the top of the tube with an intensely hot, colorless flame.

How would you measure heat? By the thermometer.

Describe a Thermometer. A thermometer consists of a glass tube with capillary bore sealed at one end, and the other end terminating in a bulb. The bulb is filled with mercury or other fluid, which, being expanded by heat, rises in the tube and indicates the degree of heat, either on an index scratched on the tube itself, or marked on a piece of paper against which the tube is placed.

Describe the three scales for marking thermometric degrees now in use. The scales are, 1. Centigrade; 2. Fahrenheit, and 3. Réaumur. In the Centigrade scale, the freezing point of water is zero, the boiling point 100°, and the intervening space is divided into 100 equal parts called degrees. In the Fahrenheit scale, the freezing point of water is 32°, the boiling point 212°, and the intervening space is divided into 180 equal parts called degrees. In the Réaumur scale, the freezing point is zero, and the boiling point 80°.

What ratio do the three scales bear to each other, and how would you convert the scale of one into the other? Ratio: 5 : 9 : 4.

FORMULÆ FOR THE CONVERSION OF DEGREES OF ONE THERMOMETRIC SCALE INTO THOSE OF ANOTHER.—*Attfield.*

F. = Fahrenheit. C. = Centigrade. R. = Réaumur. D. = Observed Degree.

If above the freezing point of water (32° F.; 0° C.; 0° R.).

F. into C., . . . $(D - 32) \div 9 \times 5$
F. " R., . . . $(D - 32) \div 9 \times 4$
C. " F., . . . $D \div 5 \times 9 + 32$
R. " F., . . . $D \div 4 \times 9 + 32$

If below 0° F. (−17.77° C.; − 14.22° R.).

F. into C., . . $-(D + 32) \div 9 \times 5$
F. " R., . . $-(D + 32) \div 9 \times 4$
C. " F., . . $-(D \div 5 \times 9) - 32$
R. " F., . . $-(D \div 4 \times 9) - 32$

If below freezing, but above 0° F. (−17.77° C.; −14.22° R.).

F. into C., . . . $-(32 - D) \div 9 \times 5$
F. " R., . . . $-(32 - D) \div 9 \times 4$
C. " F., ... $32 - (D \div 5 \times 9)$
R. " F., . . . $32 - (D \div 4 \times 9)$

For all degrees,

C. into R., ... $D \div 5 \times 4$
R. " C., ... $D \div 4 \times 5$

RULES.

1. To convert Centigrade degrees into those of Fahrenheit above 32, multiply by 1.8 and add 32.

2. To convert Fahrenheit degrees above 32 into those of Centigrade, subtract 32 and divide by 1.8.—*Remington.*

How would you select a thermometer? Choose one made of glass, thick enough to be strong, but thin enough to be delicate, with graduations marked on tube, which should be of equal diameter throughout, with flat or elliptical, perfectly uniform bore. It should be free from air, which may be tested by inverting the instrument and seeing that the mercury descends to the lowest part of the tube.

What is a blow-pipe, and how is it used? A slightly conical, gradually tapering metallic or glass tube, covered at the smaller end, and having a minute orifice at that end for producing a blast. When used, an unremitting current of air is forced through the tube from the mouth, by keeping the cheeks distended with air and constantly supplying fresh air from the lungs, as needed.

Describe the nature of the blow-pipe blast. 1st. It has an intense heat. 2d. When used with a luminous flame, the interior of the blow-pipe blast, owing to the carbon not being wholly oxidized, has the power of reducing oxides. It is, therefore, called the *reducing* flame. The outer part of the blast has the opposite or oxidizing property, and is called the *oxidizing* flame.

What is the blow-pipe used for in Pharmacy? Used for bending and working glass, testing fusible chemical substances, in soldering, etc.

What is a Crucible, and for what is it used? A crucible is a cup-shaped vessel, intended to withstand a powerful heat. Clay, plumbago, porcelain, iron, silver, and platinum, are some of the materials employed for crucibles. Platinum ranks first, plumbago second, the Hessian crucible next, though quite inferior; then comes the more fragile porcelain and wedgwood crucibles, which must be gradually cooled, to prevent breakage.

What eight processes in Pharmacy require the application of high heat? 1. *Ignition*. 2. *Fusion*. 3. *Calcination*. 4. *Deflagration*. 5. *Carbonization*. 6. *Torrefaction*. 7. *Incineration*. 8. *Sublimation*.

Describe each of these processes. 1. *Ignition* consists in strongly heating solid or semi-solid substances to obtain a definite residue. Ex. The official quantitative tests for purified sulphide of antimony, phosphoric acid, etc.

2. *Fusion* is the process of liquefying solid bodies by heat. Ex. Melting of iron or lead, or of wax.

3. *Calcination* is the process of driving off volatile substances, such as gas or water, from inorganic matter, by heat without fusion. Ex. Magnesia, lime, etc., prepared by calcination.

4. *Deflagration* is the process of heating one inorganic substance with another capable of yielding oxygen (usually a nitrate or a chlorate); decomposition ensues, accompanied by a violent, noisy, or sudden combustion. Ex. Salts of As and Sb made by this process.

9. *Carbonization* is the process of heating organic substances *without* the access of air, until they are *charred*. The volatile products are driven off, but combustion is prevented. Ex. Charcoal is made in this way.

6. *Torrefaction* is the process of roasting organic substances. The constituents are modified but not charred. Ex. The roasting of coffee. *Torrefied Rhubarb* is obtained in this way. It loses its cathartic properties by this process, but retains its properties as an astringent.

7. *Incineration* means the burning of organic substances to ashes in air. The ash is the part sought. Ex. Determining the amount of fixed matter in organic substances by burning them and examining the ashes.

8. *Sublimation* is the process of distilling solid volatile substances from non-volatile substances. Ex. Camphor is separated from strips of wood from the camphor tree in this way.

What various forms of apparatus are used to modify and control heat? The water-bath, salt-water bath, sand-bath, oil-bath, glycerin-bath, etc.

Limit the range of the several forms of bath. The water-bath can only be used for temperatures below 100° C. (212° F.). Saturated salt solution boils at 108.4° C. (227.1° F.), which degree limits the range of the salt-water bath. Glycerin may be heated to 250° C. (480° F.) without much inconvenience from the Acrolein, which is produced when that substance is raised nearly to the boiling point. The oil-bath is designed to furnish a regulated temperature below 260° C. (500° F.), and the sand-bath may be used at any temperature.

Upon what theory is Steam used in pharmaceutical operations? Matter exists in three forms: *solid*, *liquid*, and *gaseous*, depending upon the degree of distance between its molecules. Heat is but another name for molecular motion (possibly atomic motion also). Increase molecular motion, and molecular distance is increased to give room between the molecules for that motion. Cohesion holds molecules together. Heat, therefore, works against cohesion. If water is heated until its molecules are driven far apart, it becomes steam, and its molecules are now in very rapid vibration. If brought into contact with a cool surface, that is, a surface of slower molecular vibration, it imparts its motion to that surface, and the steam is condensed—its motion is lost, and it returns to the condition of fluid again. But by imparting its heat (motion) to the surface with which it came in contact, this surface becomes heated. The molecular motion of the surface becomes as great as the steam when equilibrium is attained and the temperature of the surface remains constant. As hot steam can be transported long distances by appropriate pipes, it becomes a convenient means of heating surfaces at a distance from the fire, and the pressure of the steam being under perfect control, the temperature may be regulated with great exactness.

In what two forms is steam used for heating? Steam without pressure, and steam under pressure, or superheated steam.

What advantage has the latter? Steam under pressure is hotter because more heat is required to raise water to the condition of vapor against increased pressure.

In what way may steam under pressure be used for evaporation? By means of jacketed kettles.*

How may the heating surface be increased in such kettles? By combining the kettle with a steam coil.

For what other purposes are steam coils used? For heating apartments, drying ovens, evaporating dishes placed upon them, and for boiling water, by placing a steam coil in the water.

OPERATIONS REQUIRING HEAT.

What is Vaporization? The operation of increasing molecular motion by heat until matter assumes the form of vapor or gas.

Explain what is meant by the various terms, Evaporation, Dis-

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* For various forms of jacketed kettles, boilers, etc., for using steam in pharmaceutical operations, see Remington's "Pharmacy."

tillation, Desiccation, Exsiccation, Granulation, Sublimation. In the vaporization of liquids, when the object sought is the fixed part, the process is called *evaporation*, when it is the volatile part that is sought, it is called *distillation*. If solids are vaporized, when the fixed part is sought, the process is called *Desiccation*, or *Exsiccation*, and when furnished in a granular condition, *Granulation ;* but if the volatile part is sought, it is called *Sublimation*.

What is Ebullition, or Boiling? A violent agitation in a liquid produced when it is heated from the fluid to the gaseous condition. The heat acts first on that portion of liquid resting against the heated surface, converting a portion into steam, which rises in the form of bubbles, which break on the surface of the liquid.

What is meant by the boiling point of a liquid? The temperature at which it boils. Each liquid has its specific boiling point as well as its specific weight. Liquids evaporate more or less at all temperatures, hence there seems to be no specific *evaporating* point, but there is a specific point where ebullition commences.

What is meant by the tension of matter? The molecules of which matter is composed repel each other, but are held together by cohesion and atmospheric pressure. Matter is, therefore, said to exist in a state of tension. The repelling force may be heat; at any rate, by increasing heat, or molecular motion, the repelling force is increased. Heat, therefore, is a force working against cohesion and atmospheric pressure, to separate molecules apart.

How may advantage be taken of the knowledge of tension to increase the rapidity of evaporation? By removing the pressure of the atmosphere from a liquid and increasing its molecular motion, viz.: heating it, evaporation is hastened.

What important factor plays a part in the evaporation of a liquid in the open air? The degree of moisture already in the air.

In evaporating liquids at the boiling point, temperature, pressure, etc., being equal, what determines the rapidity of evaporation? The amount of surface exposed to the heat.

What determines the rapidity of evaporation under like circumstances below the boiling point? The amount of surface exposed to the air.

How would you apply this knowledge? By selecting suitable vessels for evaporation, and employing various devices to increase the heating surface, or the surface exposed to the air, depending upon the method of evaporation chosen.

What is a Vacuum Pan? A covered evaporating pan, with an air pump, condenser, etc., for removing the pressure of the atmosphere while conducting the process of evaporation, thus enabling the liquid to boil at a lower temperature.

What is an evaporating chamber? A species of "fume-closet," built into a chimney breast, provided with gas-burners, etc., for conducting evaporation.

How would you protect a vessel from unequal heating by the flame when evaporating by direct heat? By a piece of wire gauze between it and the flame.

How would you evaporate a liquid to a fixed weight? Use a tared dish, and weigh both dish and contents when required.

How would you evaporate to a fixed volume? Use a graduated evaporating dish, and evaporate to the required volume.

How would you mark the evaporating dish to determine the required volume? Dishes may be bought already graduated, or graduated in the laboratory, either by marking the dish on the inside or pasting a strip of paper to the inside, marked with the required measure. A strip of wood placed across the top of the dish, perforated in the middle for a glass thermometer, can be used for graduating purposes, by tying a string on the thermometer to indicate the desired level.

What is a Hood? A contrivance connected with a chimney to place over evaporating dishes, etc., to conduct away vapors.

What is a Grommet? A circular bit of rubber hose upon which a round-bottomed dish may be placed to keep it from turning over.

What is meant by Spontaneous Evaporation? The evaporation of a liquid at the ordinary temperature of the atmosphere.

What is Distillation? The operation of separating one liquid from another, or a liquid from a solid, by *vaporization* and *condensation*, the volatile part being the object sought.

About how much water is required to condense steam at 100° C. (212° F.)? About twenty-five times its weight of water, at 20° C. (68° F.).

Describe the two typical forms of apparatus used in distillation. 1st. The *alembic* consists of a *head* or *dome*, in which the vapors generated in the *body* or *cucurbil* are condensed and run into a gutter at the base of the dome, and are carried off by a pipe. The use of the alembic in its original form is nearly obsolete. 2d. The retort consists of a long-necked flask, with the neck bent at right angles with the body of the flask. When the flask has a *tubulure*, or orifice at the top of the body, for the purpose of introducing the liquid to be distilled, it is called a *tubulated* retort. Other materials, besides glass, are used for making retorts.

How would you select a retort? For very volatile liquids a deep retort is preferable. The bottom of the neck should form an acute angle with the body. The tubulure should be situated well back, to admit a funnel without striking the bottom of the neck. The neck should taper gradually, permitting the use of a rubber ring, to form a tight joint between it and the condenser, the ring being made tight by forcing it up the gradually tapering neck. The glass should neither be too thick nor too thin, well annealed, and free from scratches, bubbles, and imperfections.

How would you improvise an ordinary flask for distillation? Select a flat-bottomed flask, with a wide mouth, to admit a large-sized rubber stopper containing a wide, bent tube, to act as a neck, a thermometer, and a safety or changing tube. The joints are made tight by *luting* them.

What is a Lute? Various pastes, which harden when dry, and serve to make joints vapor-proof, are called lutes. Flaxseed meal poured into boiling water and stirred into a paste is generally used.

How may glass tubes be connected with each other? By rubber tubing, or pieces of bladder moistened and wrapped around the proposed joint, and tying with strong linen twine.

What are Receivers? Glass vessels, usually globular in shape, for receiving distillates. Three kinds are used; plain, *tubulated*, and *quilled*. The tubulure is to prevent explosions, and the quill to allow the distillate to escape, for the purpose of measuring it as it condenses.

What are Adapters? Tapering tubes of glass, used to connect retorts with receivers.

How would you charge a retort? A plain retort should be charged with a long-beaked funnel, reaching well down into the body of the retort. Place a funnel in the tubulure, to charge a tubulated retort.

How are retorts supported? By retort stands, of which there are several patterns.

What is meant by bumping, and how may it be prevented? Certain explosions occurring in a liquid when it is boiled. It may be prevented by placing some pieces of broken glass in the retort.

What is a Liebig's Condenser? Two long tubes, the smaller inside the larger, and sufficient space between them to allow the free circulation of water, are kept in place by rubber rings between them at each end of the apparatus. The inside tube is longer, to allow it to be connected at one end with a retort, and the other end with a receiver. The apparatus is inclined at an angle on a stand, and, when in use, cold water is circulated between the tubes, entering at an orifice situated at the lower end, and escaping at a similar orifice situated at the top, thus condensing the vapors passing through the inner tube.

What is a Still? Various forms of apparatus embracing the principles of the alembic and retort, either singly or combined, used for distillation, are called stills. When the neck of the retort is prolonged into a coil and immersed in water to condense the vapors, it is called a *worm*.

What is Sublimation? The process of distilling volatile solids. The product is called a *sublimate*.

Describe the product: 1st. Cake sublimate; 2d. Powder sublimate. When the volatile product condenses at a temperature but slightly lower than the condensing point, the deposit is made slowly and a large cake of crystals is produced. But if the vapor is condensed rapidly in a cold temperature, a powder results. Retorts and hoods of various patterns are used for sublimation, or the vapor may be condensed in chambers specially arranged for the purpose.

What is meant by Desiccation? The operation of drying medicinal substances.

What are the three objects for drying medicinal substances? 1. To aid in preserving them. 2. To reduce their bulk. 3. To facilitate their comminution. The operation is effected by various forms of ovens and drying closets, described in works on pharmacy.

OPERATIONS NOT REQUIRING HEAT.

What is meant by Comminution? The process of tearing drugs to pieces or reducing them to powder.

Name some of the processes for comminuting drugs. Cutting, rasping, grating, chopping, contusing, rolling, stamping, grinding, powdering, triturating, levigating, elutriating, granulating, etc.

What instruments may be used for cutting, slicing, or chopping? Pruning-knife, pruning-shears, tobacco-knife, or herb cutter.

What instrument for grating? Half-round rasp.

What for contusion? Iron pestle and mortar, or the pestle and mortar may be made of wood or marble.

What is meant by the terms Grinding and Pulverizing? Grinding means reducing substances to *coarse* particles. Pulverizing means reducing to *fine* particles.

What is a Drug Mill? A mill for comminuting drugs.

Into what four general divisions are drug mills divided? Burr stone-mills, roller-mills, chaser-mills, and hand-mills.

Describe the principle of each. A burr-stone-mill consists of two disks of stone, rubbing together, the approximating faces being cut in grooves, to afford grinding surfaces.

Roller-mills consist of rollers revolving in opposite directions, the distances between them being regulated by screws. They operate by crushing, or cutting and crushing, and the rollers are made smooth, or with corrugations, serrations, undulations, or crenations, according to the nature of the drug which is to be operated on.

Chaser-mills consist of two heavy granite stones revolving on a circular granite base, surrounded by an iron curb. They operate by crushing and by the friction engendered by the outer edge of the stone traveling through a longer distance than the inner edge.

Hand-mills are divided into three classes, according to the arrangement of their grinding surfaces, which may be *vertical*, *horizontal* or *conical*. They are made of iron, with grinding plates of hardened iron or steel, and thumb-screws to regulate the distance between the grinding faces.

What is meant by Trituration? Rubbing substances to fine particles by means of a pestle and mortar.

Describe the process. Give the pestle a circular motion with downward pressure. Commencing in the centre of the mortar, work outward in ever increasing circles till the side of the mortar is touched, then reverse the motion and decrease the size of the circles till the centre is reached.

How should a pestle fit its mortar? See that the pestle has as much bearing on the interior surface of the mortar as its size will permit, to secure as much triturating surface as possible.

Of what substances are pestles and mortars for trituration composed? Wedgwood, porcelain, and glass.

What is a Spatula? A flexible steel blade fixed in a handle, and used for various purposes in pharmacy. In trituration it may be used to loosen up the substance when it becomes packed upon the sides of the mortar. The best form of spatula is that known as the balance handle.

How may the fineness of powders be regulated? By sieves of various construction, with meshes of different sizes, as required. It is important that all portions of the sifted powder be thoroughly mixed, in order to secure uniform composition.

Powders are known as *very fine* (sieve with 80 meshes to the linear inch); *fine* (60 m. to l. i.); *moderately fine* (50 m. to l. i.); *moderately coarse* (40 m. to l. i.); *coarse* (20 m. to l. i.). These powders are also known by number, as Nos. 80, 60, 50, 40, and 20, respectively. Iron wire, brass wire, bolting cloth, and horse hair are the materials usually chosen for sieves.

What is Levigation? "The process of reducing substances to a state of minute division by triturating them after they have been made into paste with water or other liquid." A slab and muller is the apparatus used for this process. When this is constructed of porphyry, the process is termed porphyrization.

What is Elutriation? If an insoluble powder be suspended in water the heavier particles will precipitate first. By decantation of the liquid, the finer portions may be separated. Prepared chalk is a familiar example. The process of making the pasty mass obtained by elutriation into little cones is called TROCHISCATION. A tinned iron cone, with a handle, is used for this purpose. The handle has a short leg in the centre, which is tapped gently on a slab, upon which the substance forced through the aperture at the bottom of the cone by the shock falls, in the form of a little conical mass. Successive shocks are employed, and the resulting conical masses deposited in this manner on the slab soon dry, the moisture being absorbed by the slab.

What is meant by Pulverization by Intervention? The process of reducing substances to powder through the use of a foreign substance, from which the powder is subsequently freed by some simple method. Ex. Camphor may be powdered with the aid of a few drops of alcohol. The foreign substance is freed from the powder by subsequent evaporation.

SOLUTION.

What is Solution? The permanent and complete incorporation of a solid or gaseous substance with a liquid. The product is called a *solution*, the liquid used a solvent, and if the solvent will dissolve no more of the substance, the product is called a *saturated solution*.

What is the difference between simple and chemical solution? In simple solution no change occurs in the chemical structure of the dissolved substance (sugar in water); but in chemical solution the reverse is the case. Ex. The official solution of nitrate of mercury,

How may solution of solids be facilitated? By pulverizing the substance the extent of surface exposed to the solvent is increased, and by agitation the frequency of the contact is augmented, thus favoring the rapidity of solution. Heat, by causing convection currents in the liquid, facilitates solution, and as heat works against cohesion, it increases the solubility of the substance.

May saturated solutions be used as solvents? Yes; a liquid saturated with one substance is still a solvent for another substance.

What effect has solution upon temperature? Simple solution lowers temperature; chemical solution raises temperature.

What is the best manner of effecting the solution of a solid? Crush the substance in a mortar with the pestle, then pour on the solvent, continually stirring the mixture.

What is meant by Circulatory solution? If the substance be placed in a bag and suspended in the solvent, a current will be engendered by the sinking of the dissolved portion from the bag, its place being supplied by fresh portions of the solvent.

What solvents are used in pharmacy? Water, first in importance, then Alcohol, Glycerin, Ether, Benzin, Chloroform, Bisulphide of Carbon, Acid, and Oils, take their respective rank as solvents.

How would you effect the solution of a gas in water? Apparatus is so arranged that the gas first passes through a wash-bottle, by which it is purified, and then allowed to bubble up through the solvent, which absorbs a portion of it during the passage.

SEPARATION OF FLUIDS FROM SOLIDS.

Name some of the processes for separating fluids from solids. Lotion, Decantation, Colation, Filtration, Clarification, Expression, Percolation, etc.

What is meant by Lotion or Displacement washing? The process of separating soluble matter from a solid, by pouring a liquid upon it, which will dissolve and wash out the soluble portion. Ex. The washing of a precipitate in a funnel by means of a Spritz bottle.

Various automatic apparatus for continuing washing are described in works on pharmacy.

What is Decantation? Separating a liquid from a solid by pouring it off. This is sometimes better effected by a siphon.

Describe a Siphon. A siphon is an inverted U-tube, with one leg longer than the other. It is first filled with the liquid, and the shorter arm immersed in the liquid contained in the vessel, and a current established in this way: The column of liquid in the shorter arm is overbalanced by the column in the longer arm, thus causing a current to flow from the shorter to the longer arm, the shorter arm drawing a fresh supply from the vessel, which is thus finally emptied.

What is meant by Colation, or Straining? The process of separating a solid from a fluid, by pouring the mixture upon a cloth or porous substance, which will permit the fluid to pass through, but will retain the solid.

What material is used for constructing Strainers? Gauze, Muslin, Flannel, Felt, etc.

What is meant by Filtration? The process of separating liquids from solids, with the view of obtaining the liquids in a transparent condition. *Filters* are made of paper, paper pulp, sand, asbestos, ground glass, charcoal, porous stone, etc.

Into what two general classes are paper filters divided? Plain and plaited. Plain filters are used for retaining and washing precipitates; plaited filters for ordinary filtering operations.

How are paper filters supported? In funnels.

What method is used for producing rapid filtration? Various methods are used, such as suction with the mouth, or by a column of falling water, to produce a partial vacuum beneath the filter, and thus hasten the process by increasing atmospheric pressure.

What is meant by Clarification? The process of separating from liquids, without the use of strainers or filters, solid substances which interfere with their transparency.

Describe the eight principal methods of Clarification.

1. *By the Application of Heat.* Heat, by diminishing the specific

gravity of viscid liquids, permits the precipitation of the heavier particles, the lighter ones rising to the top. Boiling facilitates the separation, as the minute bubbles of steam adhere to the particles, and rise with them to form scum, which may be skimmed off.

2. *By increasing the Fluidity of the Liquid.* This may be done by diluting it with water. Owing to the diminished specific gravity, the heavier particles sink, and the liquid may then be decanted.

3. *Through the use of Albumin.* If albumin be added to the turbid liquid, and heat applied, on coagulating it will envelop the particles, and rise to the top with them. Skimming will remove the scum.

4. *Through the use of Gelatin.* Gelatin will form with tannin an insoluble compound, and where cloudiness is due to the presence of tannin, will clarify the liquid in this way.

5. *Through the use of Milk.* Acids will precipitate the casein of milk. It is used in sour wines, etc., the precipitated casein carrying with it the insoluble particles.

6. *Through the use of Paper Pulp.* Agitate the liquid with the pulp and let it stand till clear; or throw the whole on a muslin strainer; the pulp will form an excellent filtering medium by partially closing the meshes of the linen.

7. *By Fermentation.* Many substances soluble in the natural juices of plants are insoluble in the dilute alcoholic solutions resulting when these juices are fermented and subside as deposits.

8. *By subsidence through long standing.* The deposit formed is called a *sediment.*

What is the difference between a Sediment and a Precipitate? "Sediment is solid matter separated merely by the action of gravity from a liquid in which it has been suspended. A precipitate, on the other hand, is solid matter separated from a solution by heat, light, or chemical action."

What is Decoloration? The process of depriving liquids or solids in solution of color by the use of animal charcoal.

How would you separate Immiscible Liquids? By the use of a pipette, a glass syringe, a separating funnel, or a Florentine receiver. A funnel with a stop-cock to stop the flow as soon as the heavier liquid has all passed through is called a separating funnel. A Florentine receiver, used in the distillation of volatile oils, differs from an ordinary receiver in having an overflow arranged to permit the escape of the condensed water while retaining the volatile oil.

What is meant by Precipitation? "The process of separating solid particles from a solution by the action of heat, light, or chemical substances." The solid particles separated are called the *precipitate*: the precipitate producer, a *precipitant*; and the liquid remaining, *supernatant liquid.* A precipitate may either fall or rise to the top of the supernatant liquid. The physical characteristics of precipitates are described by the words *curdy*, *granular*, *flocculent*, *gelatinous*, crystalline, bulky, etc. A *magma* is a thick, tenacious precipitate. Precipitation by heat is illustrated by the coagulation and precipitation of albumin when albuminous fluids are heated; and the precipitation of silver salts by light illustrates precipitation by light; and precipitation by chemical reaction occurs in a large number of instances when making official chemical salts. Example: the preparation of Precip. Carb. Calcium.

What are the objects of Precipitation? 1st. A method of obtaining substances in the form of powder. 2. A method of purification. 3. A method of testing chemicals. 4. A method of separating chemical substances.

Vessels of glass called precipitating jars are made. They are larger at the bottom than the top. Hot, dense solutions usually produce heavy precipitates, and the reverse is the case when dilute solutions are employed. Precipitates may be collected in a funnel on filtering paper or on strainers.

CRYSTALLIZATION.

What is Crystallization? The process of placing substances under the most favorable circumstances for them to assume certain inherent geometrical forms called *crystals*. Substances that will not crystallize are called *amorphous*. *Crystallography* is that department of knowledge devoted to crystals. The objects of crystallization are to increase the purity and beauty of chemicals.

1. MEANING OF TERMS.

Faces—the planes bounding a crystal.

Edge—the intersection of two contiguous surfaces.

Angle—the intersection of three or more faces.

Perfect crystal—a crystal in which the faces, edges, or angles have equal faces, edges, or angles opposite to them, and if the middle point of the opposite faces or edges or the opposite angles be joined by straight lines, the point at which these lines intersect will be the centre of the crystals.

Axes—the lines drawn through the centre of crystals.

Dimorphous, trimorphous, polymorphous, etc.—when the same body crystallizes in two or more forms belonging to different systems.

Isomorphous—when *different* substances crystallize in the same form.

Prismatic—crystals extended principally in the direction of their longer axes.

Tabular—crystals with flat planes.

Laminæ—crystals in the form of thin plates.

Acicular—needle-shaped.

Orthometric—those in which the three axes intersect at right angles.

Clinometric—those in which the axes intersect at oblique angles.

2. SYSTEMS.

Six different systems of crystallization are recognized. The word system is used because 'every crystallizable body assumes its own characteristic form or some form directly derived from it by a single law,' so that several forms may belong to the same system.

I. *Monometric* or *Regular*.—The angles of equal length intersecting at right angles.

II. *Dimetric* or *Quadratic*.—Three axes, two equal, the other different in length, all intersecting at right angles.

III. *Trimetric* or *Rhombic*.—Three axes of unequal length intersecting at right angles.

IV. *Hexagonal* or *Rhombohedric.*—Four axes, three of equal length, in the same plane, and inclined to one another at an angle of 60°. Fourth axis different length, and intersecting the planes of the other three at right angles.

V. *Monoclinic* or *Oblique Prismatic.*—Three axes of unequal length; two obliquely inclined to each other, the other axis forming right angles with these two.

VI. *Triclinic* or *Doubly-oblique Prismatic.*—Three axes of unequal length, all obliquely inclined to each other.

What is meant by Cleavage? The tendency of crystals to split in one direction more than another.

By what method would you obtain crystals? 1. By fusion and partial cooling (sulphur, camphor, etc.). 2. Sublimation (corrosive sublimate). 3. Deposition from hot, supersaturated solutions on cooling. 4. Deposition during evaporation. 5. Galvanism (deposited while current is passing through solution). 6. Precipitation. 7. By adding a solid substance having a strong affinity for water. (If $CaCl_2$ be added to a solution of NaCl, the latter will crystallize out.)

What is meant by Water of Crystallization? In the act of crystallizing, many substances combine with water. This is known as water of crystallization. The amount varies in the same crystal under different circumstances. When crystals lose their water of crystallization, and form a white powder on their surfaces, they are said to *effloresce*. Crystals that absorb water from the air are said to be *hygroscopic*. The act is called *deliquescence* when sufficient water is absorbed to liquefy the substance.

What is meant by Mother liquor? The liquid remaining after the crystals have formed.

What is Dialysis? The separation of crystallizable from non-crystallizable substances by osmosis.

What is a Dialyzer? A vessel with a parchment head, like a drumhead, at one end, into which the substances to be separated are placed in the form of solution. This is floated on distilled water, and by osmosis the crystallizable substance transudes through the membrane into the water below, leaving the non-crystallizable substance behind.

Crystalloids.—Crystallizable substances. Ex., sugar, salt, chemical substances.

Colloids.—Non-crystallizable substances—glue, gum, starch, dextrine, etc.

Diffusate.—The impregnated distilled water.

What is Maceration? Soaking a drug in a solvent until the soluble portions are dissolved.

What is Expression? The process of *forcibly* separating liquids from solids.

Name the six mechanical principles employed in constructing presses. 1. Spiral-twist Press. 2. Screw Press. 3. Roller Press. 4. Wedge Press. 5. Lever Press. 6. Hydraulic Press. (For full descriptions of these presses, see Remington's "Pharmacy.")

PERCOLATION.

What is Percolation? Percolation is the process whereby a powder contained in a suitable vessel is deprived of its soluble constituents by the descent of a solvent through it.

By what other name is it called? Displacement.

Give a familiar example. The percolation of water through wood ashes, by which it is exhausted of its potash, etc., the solution being known as lye.

What is the use of this process in Pharmacy? It is used for extracting the virtues of drugs, in the preparation of tinctures, fluid extracts, etc.

Describe a Percolator. A Percolator is a cylindrical vessel with a porous diaphragm below, into which the drug, in the form of a powder, is introduced, and its soluble portions extracted by the descent of a solvent through it.

Describe the rationale of the process. The solvent, which is poured on the top of the powder, in passing downward exercises its solvent power on the successive layers of the powder until saturated, and is impelled downward by the combined force of its own gravity and that of the column of liquid above, minus the capillary force with which the powder tends to retain it.

What is a Menstruum? The solvent is known technically by this name.

What is a Percolate? The liquid coming from the Percolator, impregnated with the soluble principles of the drug.

Why is Percolation also called the process of Displacement? Because it was first observed that ether, poured on powdered bitter-almonds, displaced the fixed oil which it contains without materially mixing with it.

Describe the condition in which the soluble principles exist in the powdered drug, and the effect of the solvent upon them. The soluble principles in the powdered drug exist in a hard and dry condition, and are generally contained in cells which are more or less disintegrated in grinding. The solvent takes up first the principle liberated by grinding, and afterward permeates the cells.

Why is it that each succeeding portion of percolate is less highly colored and less active than the one preceding it? Because the first portion of menstruum, in its descent through the powder, has the first opportunity to come in contact with the largest portions of the soluble principles, which are to be found in the finer dust scattered through the powder, and in the thoroughly disintegrated particles, which offer but slight resistance to the passage of the menstruum.

What are the directions of the U. S. P. upon Percolation? The process of percolation, or displacement, directed in this Pharmacopœia, consists in subjecting a substance, in powder, contained in a vessel called a percolator, to the solvent action of successive proportions of menstruum in such a manner that the liquid, as it traverses the powder in its descent to the recipient, shall be charged with the soluble portion of it, and pass *from the* percolator free from insoluble matter.

When the process is successfully conducted, the first portion of the liquid, or percolate, passing through the percolator will be nearly saturated with the soluble constituents of the substance treated; and if the quantity of menstruum be sufficient for its exhaustion, the last portion of the percolate will be destitute of color, odor, and taste, other than that possessed by the menstruum itself.

The percolator most suitable for the quantities contemplated by this Pharmacopœia, should be nearly cylindrical, or slightly conical, with a funnel-shaped termination at the smaller end. The neck of this funnel-end should be rather short, and should gradually and regularly become narrower toward the orifice, so that a perforated cork, bearing a short glass tube, may be tightly wedged into it from within, until the end of the cork is flush with its outer edge. The glass tube, which must not protrude above the inner surface of the cork, should extend from one and one-eighth to one and one-half inch (3 to 4 centimetres) beyond the outer surface of the cork, and should be provided with a closely-fitting, narrow tube, at least one-fourth longer than the percolator itself, and ending in another short glass tube, whereby the rubber tube may be so suspended that its orifice shall be above the surface of the menstruum in the percolator, a rubber band holding it in position.

The shape of a percolator should be adapted to the nature of the drug to be operated upon. For drugs which are apt to swell, particularly when a feebly alcoholic or an aqueous menstruum is employed, a *conical* percolator is preferable. A *cylindrical* or only slightly tapering percolator may be used for drugs which are not liable to swell, and when the menstruum is strongly alcoholic, or when ether or some other volatile liquid is used for extraction. The size of the percolator selected should be in proportion to the quantity of drug to be extracted. When properly packed in the percolator, the drug should not occupy more than two-thirds its height. The percolator is best constructed of glass, or stone-ware, but, unless otherwise directed, may be made of any suitable material not affected by the drug or menstruum.

The percolator is prepared for percolation by gently pressing a small tuft of cotton into the space of the neck above the cork, and a small layer of clean and dry sand is then poured upon the surface of the cotton to hold it in its place.

The powdered substance to be percolated (which must be uniformly of the fineness directed in the formula, and should be perfectly air-dry before it is weighed) is put in a basin, the specified quantity of menstruum is poured on, and it is thoroughly stirred with a spatula or other suitable instrument, until it appears uniformly moistened. The moist powder is then passed through a coarse sieve—No. 40 powders, and those which are finer, requiring a No. 20 sieve; whilst No. 30 powders require a No. 15 sieve for this purpose. Powders of a less degree of fineness usually do not require this additional treatment after the moistening. The moist powder is now transferred to a sheet of thick paper, and the whole quantity poured from it to the percolator. It is then shaken down lightly and allowed to remain in that condition for a period varying from fifteen minutes to several hours, unless otherwise directed: after which the powder is pressed, by the aid of a plunger of suitable dimensions, more or less firmly, in proportion to the character of the powdered substance and the alcoholic strength of the menstruum; strongly alcoholic menstrua, as a rule, permitting firmer packing of the powder than the weaker. The percolator is now placed in position for percolation, and the rubber tube having been fastened at a suitable height, the surface of the powder is covered by an accurately-fitting disk of filtering paper or other suitable material, and a sufficient quantity of the menstruum poured on through a funnel reaching nearly to the surface of the paper. If these conditions are accurately observed, the menstruum will penetrate the powder equally until it has passed into the rubber tube and has reached, in this, the height corresponding to its level in the percolator, which is now closely covered to prevent evaporation, and the apparatus allowed to stand at rest for the time specified in the formula.

To begin percolation, the rubber tube is lowered and its glass end introduced into the neck of a bottle previously marked for the quantity of liquid to be percolated, if the percolate is to be measured, or of a tared bottle if the percolate is to be weighed; and by raising or lowering this recipient, the rapidity of percolation may be increased or lessened, as may be desirable, observing, however, that the rate of percolation, unless the quantity of material taken in operation is largely in excess of the Pharmacopœial quantities, shall not exceed the limit of ten to thirty drops in a minute. A layer of menstruum must constantly be maintained above the powder, so as to prevent the access of air to its interstices, until all has been added, or the requisite quantity of percolate obtained. This is conveniently accomplished, if the space above the powder will admit it, by inverting a bottle containing the entire quantity of menstruum over the percolator in such a manner that its mouth may dip beneath the surface of the liquid, the bottle being of such shape that its shoulder will serve as a cover for the percolator.

When the dregs of a tincture, or of a similar preparation, are to be subjected to percolation, after maceration with all or with the greater portion of the menstruum, the liquid portion should be drained off as completely as possible, the solid portion packed in a percolator, as before described, and the liquid poured on, until all has passed from the surface, when immediately a sufficient quantity of the original menstruum shall be poured on to displace the absorbed liquid, until the prescribed quantity has been obtained.

What is the best Percolator for common use? An ordinary glass funnel.

What is the objection to the glass funnel? It is too broad for use in percolating drugs for fluid extracts when the quantity of drug is large in proportion to the quantity of menstruum.

What is the desirable shape for making this class of preparations? A tall, narrow Percolator.

Why? Because it is desirable that the menstruum should traverse a higher column of powder.

What is gained by this? 1st. Every drop of menstruum is economically applied; 2d, the rate of flow is diminished; 3d, the percolate becomes saturated more rapidly; 4th, the operation is, therefore, more easily controlled.

What general rule may be given for selecting percolators? For making fluid extracts, a tall, straight percolator, should be selected; for making a strong tincture, the percolator should be slightly bell-shaped and wider; for making weak tinctures, use a funnel.

How would you limit these rules? The character of the drug influences the limit. Those containing a large amount of soluble matter, like kino, cannot be percolated in a tall, narrow funnel, because the percolate would soon become too dense to descend.

What influences the degree of comminution proper for each substance? It depends, 1st, upon the physical structure of the drug; 2d, the ease with which the menstruum dissolves the desired constituents; 3d, the length of time required to exhaust the powder; 4th, the relative proportion of menstruum to drug.

Why does the Pharmacopœia direct that the drug shall be passed through a coarse sieve after moistening? To render it uniform.

Why should the powder be moistened? 1st, a moist powder, like a moist sponge, greedily absorbs moisture, but a dry powder, like a dry sponge, repels attempts to moisten it; 2d, dry powders have a tendency to swell when moistened, which, owing to the pressure of the particles against each other and the sides of the percolator, prevent menstrua from penetrating them.

State the exceptions to the rule for moistening powders. Powders should not be moistened, 1st, when the addition of the menstruum would produce lumping, owing to the adhesive nature of the drug; 2d, when the moistened powder would offer too little resistance to the passage of the menstrum; 3d, those in which the menstruum is too volatile or too inflammable to render moistening desirable or safe. The cold percolation of sugar in making syrups illustrates the first; the preparation of oleoresins with ether illustrates the second and third.

Of what should the porous diaphragm be composed? Porous cotton, a deeply notched cork, or a perforated plug of cork or wood.

The porous diaphragm should be covered with clean sand, or a disk of scored filter paper, except when absorbent cotton is used. *Always* moisten the porous diaphragm with a *portion of the menstruum* before packing the percolator.

How should a percolator be packed? It should be packed in layers, each succeeding layer being packed according to the directions, "moderately" or "firmly," as the case may be, care being taken to use the same degree of pressure with each layer.

How would you test the correctness of the packing? By the descent of the menstruum, which should descend slowly and uniformly.

What general rule is given in relation to the degree of pressure to use in packing percolators? Porous, spongy drugs, and menstrua largely aqueous, require moderate packing. If a strongly alcoholic menstruum is directed, pack firmly.

How would you add the menstruum? Cover the top of the powder with a sheet of scored filter paper, place a weight upon it to keep it in place, and add the menstruum in divided portions, care being taken to follow with the succeeding portion before the first one has entirely disappeared, to prevent fissures forming in the powder, and the leaking of the menstruum through the fissures.

Why does the Pharmacopœia direct previous maceration of the powder before percolation? Because most drugs are not easily extracted by the menstruum, owing to the toughness of the powder, or nature of the desired principles, and maceration secures contact with the solvent for a longer time.

How is this maceration best effected? By introducing the moistened drug loosely into the percolator, and covering it closely, to prevent loss by evaporation.

How can it be determined if the drug is exhausted? Only by knowing beforehand what the active principles of the drug are, and testing the percolate, until they are no longer contained therein.

For example: The absence of bitterness in the percolate, from nux vomica, opium, and cinchona, indicates that the bitter alkaloids, to which their activities are due, have been thoroughly extracted from the drug; the absence of color in the percolate of cochineal and saffron, indicates that the desired coloring matters have been exhausted from the drugs, and the absence of astringency in the percolate, of drugs whose activities are due to tannic acid, indicates that it has been completely extracted.

What is the best menstruum for extracting a drug? The best menstruum for extracting a drug is one that will deprive it of its active and desirable principles, and leave in the residue those principles which are either inert or objectionable.

What other important points are to be taken into consideration in choosing a menstruum? A menstruum should always be chosen exactly adapted to the characteristics of the drug, and which will cause the retention of the soluble principles in a permanent form under the varying conditions of climate, and at the same time permit exposure to light, heat, and air without injury.

How can this be determined? Only by experiment.

Can it be accurately predetermined what amount of menstruum a powder will absorb and retain after percolation ceases? It cannot. The amount varies according to the nature of the drug employed, sometimes as much as eight to twenty per cent.

What great advantage does percolation have over maceration in respect to the character of liquid left in the residue? Maceration leaves a finished tincture in the residue; in percolation it is merely menstruum, the active portions of the drug having been dissolved in the preceding percolate.

How can absorbed menstrua be recovered? By distillation, or by treating the residue, first with weak alcohol, then with water.

When water causes a swelling of the substance and stops percolation, what expedients may be resorted to? Mix the residue with clean sawdust, rice chaff, or other inert dry substances, then percolate with water.

How may recovered distilled alcohol be purified? By treating it with permanganate of potassium (12 grains to the gallon), letting it stand a few days, then decanting or filtering.

In conducting the operation of Percolation, how would you control the flow of the Percolate? By the amount of pressure in packing; *by raising* or lowering the receiver containing the nozzle of the delivery tube, as directed by the U. S. P.; by using a stop-cock (objectionable); or by adopting one of the several forms of percolators devised for that purpose.

Mention some of the special percolators devised as improvements on the ordinary cylindrical and conical percolators, and the principles upon which they are founded. 1. Drusse's glass percolator. In this percolator evaporation is prevented by means of a ground-glass cover. The flow of the percolate is checked by screwing in the cover; should it flow too slowly, a piece of twine between the cover and the side will permit the necessary atmospheric pressure.

2. Squibb's Well-tube Percolator. In this percolator a large glass tube, called a well-tube, is placed in the centre of a stone-ware crock and slightly raised from the bottom by absorbent cotton; around it is packed the substance to be percolated, the menstruum is poured on the powder, trickles through and rises in the well, from which it is siphoned.

3. Double-tube Percolator. An ordinary percolator is used. In it is placed a well-tube, with a smaller tube telescoped therein, the end of the latter projecting for a few inches below the percolator through a tightly-fitting cork. The well-tube rests on absorbent cotton. The menstruum percolates through the powder, permeates the cotton, and rises in the well-tube to the top of the smaller tube therein, over which it runs into the tube and out, being received in a vessel below. The height of the percolate in the well-tube, and consequently the rapidity of the flow, is controlled by raising or lowering the inner tube.

4. Suspended Percolator (Hance Bros. & White). This percolator is so arranged, being suspended by trunnions from a beam, that it can be readily turned upside down and emptied of its contents. It is suitable for large operations.

How would you support a Percolator? Several methods are in use; 1st, the ordinary retort stand (flimsy); 2d, Remington's Percolating Stand; this instrument consists of two parallel shelves, one above the other; each shelf consists of two parallel strips having slots down the centre, fastened to which, by thumb-screws working in the slots, are cross-pieces, having their inside edges hollowed out to receive the percolator. The cross-pieces may be slid either way to enlarge or reduce the space between them so as to fit percolators of all sizes. This excellent apparatus is suspended from the wall by brackets. The advantage is that it enables all percolating and filtering operations to be carried on with convenience in one place, thus saving time and labor.

3. Shinn's Percolating Closet consists of adjustable retort rings sliding up and down on gas-pipe supports, with conveniently arranged shelves, all enclosed in a convenient closet.

What kind of Receiving Bottles should be used for the Percolate? Wide-mouth bottles are preferred. Where special accuracy is required, use a flask with a double mark on the neck. Bottles may be graduated by pasting a paper slip on the side, pouring in accurately measured quantities of water, carefully marking the height at each addition. A strip of adhesive plaster answers an excellent purpose.

What is meant by Repercolation? Repercolation is a process introduced by Dr. Squibb, and consists in "the successive application of the same percolating menstruum to fresh supplies of the substance to be percolated."

What are its advantages? By passing the weaker portions of the percolate through fresh portions of drug, it becomes thoroughly saturated. In this way a portion of the percolate will do work as menstruum, resulting in the saving of menstruum.

What is Fractional Percolation? A term used to define percolation when applied to two successive portions of powder. (Principle identical with repercolation.)

PART II.

THE FORMS OF PHARMACEUTICAL PREPARATIONS DIRECTED BY THE UNITED STATES PHARMACOPŒIA.

CLASSIFICATION OF OFFICIAL PREPARATIONS.

(*Remington.*)

LIQUIDS.

Made without percolation or maceration.

Aqueous Solutions.

Waters,
Solutions.

Aqueous Solutions Containing Sweet or Viscid Substances.

Syrups,
Honeys,
Mucilages,
Emulsions,
Mixtures,
Glycerites,

Alcoholic Solutions.

Spirits,
Elixirs.

Ethereal Solutions.

Collodions.

Oleaginous Solutions.

Liniments,
Oleates.

Made by percolation or maceration.

Aqueous Liquids.

Infusions,
Decoctions.

Alcoholic Liquids.

Tinctures.
Wines.
Fluid Extracts

Ethereal Liquids.

Oleoresins,

Acetous Liquids.

Vinegars.

SOLIDS.

Made by percolation or maceration.

Extracts,
Resins.

Made without percolation or maceration.

Powders,
Triturations,
Masses,
Confections,
Pills,
Troches,
Cerates,
Ointments,
Plasters,
Papers,
Suppositories.

Roman type, internal use. **Italic type, external use.**

LIQUIDS.

AQUEOUS SOLUTIONS.

AQUÆ—WATERS.

Aqua or Water. An aqueous solution of a volatile substance. There are eighteen official waters, three classes, according to their method of preparation. (1) Direct Solution. (2) Filtration through an absorbent powder. (3) Distillation.

THREE CLASSES.

(1) Direct Solution.—*Simple Agitation.* Aqua Amygdalæ Amaræ; Chloroformi; Creosoti.

By Dissolving Gases in Cold Water.—Aqua Ammoniæ; Ammoniæ Fortior; Chlori; Hydrogenii Dioxidi.[*]

(2) Filtration through an Absorbent Powder.—Aqua Anisi; Camphoræ; Cinnamomi; Fœniculi; Menthæ Piperitæ, and Menthæ Viridis. All made by percolation through impregnated Precipitated Calcium Phosphate. In preparing Aqua Camphoræ, a little alcohol is used with the Precipitated Calcium Phosphate, to aid in the trituration of the camphor.

(3) Distillation.—Aqua Aurantii Florum Fortior; Aurantii Florum; Rosæ Fortior; Rosæ; and Aqua Destillata.

Aqua Ammoniæ. Contains 10 p. c. ammonia gas by weight. Externally stimulant, irritant or caustic. Internally antacid and stimulant. Dose 0.6–1.9 C.c. (10 to 30 drops). Should be largely diluted when taken internally. Useful in heartburn, sick headache, syncope. Slowly injected into a vein, a powerful stimulant to heart and respiration.

Aqua Ammoniæ Fortior (Stronger Ammonia Water). Contains 28 p. c. gas by weight. Used for making Aqua Ammonia, or properly diluted (4 or 5 to 8) as a rubefacient, vesicatory, or escharotic. Apply on cotton confined in top of a pill box.

Aqua Amygdalæ Amaræ. (0.2 p. c.). Useful vehicle.

Aqua Anisi. (0.2 p. c. oil). Useful vehicle.

Aqua Aurantii Florum. Prepared by diluting the stronger water with equal volumes distilled water, and is also used as a vehicle.

Aqua Aurantii Florum Fortior (Triple Orange Flower Water). Water saturated with the volatile oil of Fresh Orange Flowers, obtained as a by-product in the distillation of the Oil of Orange Flowers. Vehicle.

Aqua Camphoræ. Camphor 0.8 dissolved in Alcohol and afterward triturated with Precipitated Calcium Phosphate.[†] Dose 15–30 C.c. (½ to 1 fl. oz.). Vehicle.

Aqua Chlori. Contains 0.4 p. c. chlorine gas. Stimulant and antiseptic. Dose 3.75–15 C.c. (1 to 4 fl. dr.), properly diluted.

Aqua Chloroformi. A saturated solution with excess of Chloroform present. Antiseptic vehicle. Dose 15–60 C.c. (½ to 2 fl. oz.).

Aqua Cinnamomi. Vehicle. Use cautiously in inflammatory affections.

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[*] Although H_2O_2 is not a gas in the usual sense of the term, the solution is classed here for sake of convenience.—(*Coblentz.*)

[†] *Precipitated* Calcium Phosphate, U. S. P.

Aqua Creosoti. 1 p. c. Creosote. Antiseptic. Stimulant externally. Local nerve paralyzant. Dose 3.69–15 C.c. (1 to 4 fl. dr.).

Aqua Destillata. 800 parts from 1000 of Water. Used for preparing the official diluted acids, for absorbing gaseous ammonia, for preparing nearly all the official aqueous solutions, and for compounding prescriptions.

Aqua Fœniculi. Vehicle.

Aqua Hydrogenii Dioxidi (Solution of Hydrogen Peroxide). 3 p.c. by weight of pure Hydrogen Dioxide. Oxidizer, deodorant, disinfectant. Coagulates the albumin of tissues. Also used in the arts for bleaching purposes.

Aqua Menthæ Piperitæ, Aqua Menthæ Viridis, and Aqua Rosæ (Stronger Rose Water and distilled Water, of each one volume). Are useful vehicles.

Aqua Rosæ (Rose Water). Prepared by mixing equal volumes of Triple Rose Water and Distilled Water. Vehicle.

Aqua Rosæ Fortior (Triple Rose Water). Water saturated with the volatile oil of rose petals, obtained as a by-product in the distillation of oil of rose.

LIQUORES–SOLUTIONS.

LIQUOR.—An aqueous solution of a chemical substance. Liquors are divided into two classes, according to the method of preparation, viz., *Simple solutions* and *solutions prepared by chemical decomposition.*

SIMPLE SOLUTIONS.

Liquor Acidi Arsenosi. Contains 1 p. c. of Arsenic by weight, and 5 p. c. diluted Hydrochloric Acid by volume. Medical properties same as Fowler's Solution. Dose 0.12–0.5 C.c. (2 to 8 minims).

Liquor Arseni et Hydrargyri Iodidi (Solution of Arsenic and Mercuric Iodide), (Donovan's Solution). Contains 1 p. c. of each of the active ingredients. Alterative. Dose 0.3–0.6 C.c. (5 to 10 drops).

Liquor Calcis (Solution of Calcium Hydrate, Lime Water). A saturated solution. Antacid, tonic and astringent. Dose 60–118 C.c. (2 to 4 fl. oz.).

Liquor Iodi Compositus (Lugol's Solution). Contains 5 p.c. Iodine, 10 p. c. Potassium Iodide. Dose 0.3 C.c. (5 minims), containing about ¼ gr. Iodine.

Liquor Plumbi Subacetatis Dilutus (Lead Water). Contains 3 p.c. of the stronger lead water. Astringent and sedative externally.

Liquor Potassæ (2d formula.) [Solution of Potassium Hydrate]. Contains about 5 p. c. of the Hydrate. Antacid, diuretic, and antilithic. Externally used as a stimulant and escharotic. Dose 0.6–1.9 p. c. (10 to 30 minims). It may be increased to 2 fl. dr. doses.

Liquor Sodæ (2d formula.) [Solution of Sodium Hydrate]. Contains 5.6 p.c. Soda. Sometimes called solution of Caustic Soda. Properties same as Liquor Potassæ.

Liquor Sodii Arsenatis. Contains 1 p.c. of Sodium Arsenate. Dose 0.18–0.3 C.c. (3 to 5 minims).

Liquor Sodii Silicatis. (Nearly saturated.) This solution is used solely in the preparation of mechanical dressings for the surgeon.

CHEMICAL SOLUTIONS.

Liquor Ammonii Acetatis (Spirit of Mindererus). An aqueous solution of ammonium acetate containing about 7 p. c. of the salt together with small amounts of acetic and carbonic acids. Made by dissolving 5 Gm. of the Carbonate in 100 C.c. diluted Acetic Acid. Diaphoretic in fevers. Dose 7.5–22.5 C.c. (2 to 6 fl. dr.).

Liquor Ferri Acetatis. An aqueous solution of Ferric Acetate, containing about 31 p. c. of the anhydrous salt, and corresponds with about 7.5 p. c. of metallic Iron. Chalybeate. Dose 0.12–0.6 C.c. (2 to 10 minims).

Liquor Ferri Chloridi. An aqueous solution of Ferric Chloride containing about 37.8 p. c. of the anhydrous salt, corresponding to 62.9 p. c. of the crystallized salt, or to about 13 p. c. of the metallic iron. Used in preparing Tincture of Ferric Chloride; also externally as a styptic to arrest hemorrhage and internally in doses of 0.12–0.6 C.c. (2 to 10 minims), as a chalybeate.

Liquor Ferri Citratis. An aqueous solution of Ferric Citrate corresponding to about 7.5 p. c. of metallic iron. Ferruginous tonic. Dose 0.6 C.c. (10 minims), equivalent to 0.33 Gm. (5 grs. of the salt).

Liquor Ferri et Ammonii Acetatis (*Basham's Mixture*). Contains in each thousand C.c. Tr. Ferri. Chlor. 20 C.c., Acid Acetic Dil. 30 C.c., Sol. Ammon. Acet. 200 C.c., Aromat. Elix. 100 C.c., Glycerin 120 C.c., Water q. s. To the Sol. Ammon. Acet. (which should not be alkaline, add, successively, the Acid, Tr., Elixir, and Glycerin, and then enough Water to make 1000 C.c.). Actively chalybeate, also astringent, and very largely used in Bright's disease. Dose 15–30 C.c. (½ to 1 fl. oz.).

Liquor Ferri Nitratis. An aqueous solution of Ferric Nitrate, containing about 6.2 p. c. of the anhydrous salt, and corresponding to about 1.4 p. c. of metallic iron. Tonic and astringent in diarrhœa, etc. In doses of 0.6 C.c. (10 drops), also when diluted as an injection in leucorrhœa, etc.

Liquor Ferri Subsulphatis (Solution of Basic Ferric Sulphate. Monsel's Solution). An aqueous solution of Basic Ferric Sulphate, of variable composition, corresponding to about 13.6 metallic iron. Styptic to bleeding surfaces; used internally in hemorrhage of stomach and bowels. Dose 0.18–0.36 C.c. (3 to 6 minims).

Liquor Ferri Tersulphatis. An aqueous solution of normal Ferric Sulphate containing about 28.7 p. c. of the salt, corresponding to about 8 p. c. of metallic Iron. Used for preparing other Iron preparations in which the Ferric Hydrate is wanted, as in the preparation of the antidote for Arsenic.

Liquor Hydrargyri Nitratis. A liquid containing about 60 p. c. of Mercuric Nitrate. Caustic application to chancre, etc.

Liquor Magnesii Citratis. Made by dissolving 15 Gm. Citric Acid in 120 C.c. of Water and adding 15 Gm. Magnesium Carbonate; dissolving; filtering into a bottle holding 360 C.c. (containing 120 C.c. Syrup of Citric Acid), adding enough Water to nearly fill the bottle, dropping in 2.5 Gm. Potassium Bicarbonate; corking, and securing the cork with *twine.*

Liquor Plumbi Subacetatis. Sometimes called *Goulard's Extract.* An aqueous liquid, containing about 25 p. c. of Lead Subacetate. Used externally as a sedative in sprains, etc., when dilute, from ½ or 1 part to 16 parts distilled water.

Liquor Potassæ. (1st formula.) Made by double decomposition between Slaked Lime and Potassium Carbonate.

Liquor Potassii Arsenitis (Fowler's Solution). A scientific substitute for *Tasteless Ague Drop.* Contains 1 p. c. Arsenic. It is a Potassium Arsenite (dissolved in water) and is formed by the combination of Arsenous acid with Potassium of the Potassium Bicarbonate (Carbon Dioxide being evolved). Compound Spirit of Lavender is added to give it taste, and prevent its being mistaken for water. 100 minims equal about 1 gr. Arsenic. Average dose 0.3 C.c. (5 drops).

Liquor Potassæ Citratis (Mistura Potassii Citratis). An aqueous liquid, containing in solution about 9 p. c. of anhydrous Potassium citrate, together with small amounts of citric and carbonic acids. Made by dissolving separately Potass. Bicarb., and Citric Acid, and afterward mixing the solution under the names *neutral mixture*, *saline mixture*, or *effervescing draught;* long used as a refrigerant diaphoretic. Dose, 15 C.c. (½ fl. oz.)

Liquor Sodæ. (1st formula.) Made by double decomposition between Slaked Lime and Sodium Carbonate.

Liquor Sodæ Chloratæ (Labarraque's Solution). An aqueous solution of several Chlorine compounds of Sodium, containing at least 2.6 p. c. by weight of available Chlorine. Stimulant, antiseptic, and resolvent. Dose from 30 drops to a teaspoonful, well diluted. Also use locally for fetor, etc. A powerful disinfectant.

Liquor Zinci Chloridi. An aqueous solution of Zinc Chloride containing about 50 p. c. by weight of salt. A substitute for Burnett's Disinfecting Fluid. Used locally to disinfect fetid discharges; also employed for preserving anatomical specimens.

AQUEOUS SOLUTIONS CONTAINING SWEET OR VISCID SUBSTANCES.

SYRUPI—SYRUPS.

What is a Syrup? A dense saccharine solution, generally medicated or flavored.

What is Sugar? Sugar is in white, dry, hard, distinctly crystalline granules, permanent in the air, odorless, having a purely sweet taste, and a neutral reaction. Commercially known as "granulated sugar."

There are thirty-two official Syrups, which may be classed, according to method of preparation, as follows:—

SYRUPS CLASSIFIED ACCORDING TO METHOD OF PREPARATION.

Title.	*Active Constituents.*	*Properties and Dose.*
HOT PROCESS.		
Syrupus		
Acidi Hydriodici, .	HI, 1 %.	Alterative, 1.25–2.5 C.c. (20 to 40 ♏).
Calcis, ...	Calcium Saccharate.	Antacid, 1.25 C.c. (20 ♏) = 1 fl. oz. Lime Water.
Picis Liquidæ, . .	Tar.	Expectorant, 3.7–7.5 C.c. (1 to 2 fl. dr.).

SYRUPS CLASSIFIED ACCORDING TO METHOD OF PREPARATION.—*Continued.*

Title.	*Active Constituents.*	*Properties and Dose.*
HOT PROCESS.		
Syrupus		
Rubi Idæi, ...	Raspberry Juice.	Vehicle.
Sarsaparillæ Compositus, ...	Fld. Ex. Sarsap.; Fl. Ex. Senna.	Alterative, 15 C.c. (½ fl. oz).
Syrupus.	Solution of 850 Gm. Sugar in *q.s.* water to 1000 C.c.	Base, and vehicle.
Tolutanus, ...	Balsam of Tolu.	Vehicle.
COLD PROCESS.		
Syrupus		
Allii, ...	Garlic.	Stimulant, Expectorant, 3.75 C.c. (1 fl. dr.).
Althææ, ...	Marshmallow.	Demulcent.
Amygdalæ,	Almond and Hydrocyanic Acid.	Demulcent, Sedative.
Aurantii, ...	Sweet Orange Peel.	Vehicle.
Aurantii Florum, .	Orange Flower Water.	Vehicle.
Calcii Lactophosphatis, ...	Calcium Lactophosphate.	Tonic, 7.5–15 C.c. (2 to 4 fl. dr.).
Hypophosphitum, .	Hypophosphites of Ca, K, and Na.	Tonic, 3.7–7.5 C.c. (1 to 2 fl. dr.).
Ipecacuanhæ, . . .	Fluid Extract Ipecac.	Expectorant, 1.9–3.7 C.c. (30 to 60 ♏). Child 0.12–0.6 C.c. (2–10 ♏.).
Lactucarii, ...	Lactucarium.	Vehicle, Sedative, 7.5–11.25 (2 to 3 fl. dr.).
Pruni Virginianæ, .	Wild Cherry.	Sedative, Vehicle, 15 C.c. (½ fl. oz.).
Scillæ,	Vinegar of Squill.	Expectorant, Diaphoretic, 3.7 C.c. (1 fl. dr.).
Scillæ Comp., . . .	Fld. Ext. Squill; Fld. Ext. Senega; Tartar Emetic.	Expectorant, Diaphoretic, 0.6–1.25–1.9 C.c. (10, 20 or 30 drops).
Senegæ, ...	Fld. Ext. Senega.	Expectorant, 3.7–7.5 C.c. (1 to 2 fl. dr.).
Sennæ, ...	Senna.	Cathartic, 7.5–15 C.c. (2 to 4 fl. dr.). Child ¼ to ½ this.
Zingiberis, ...	Fld. Ext. Ginger.	Vehicle, 3.7 C.c. (1 fl. dr.) or more.
SIMPLE ADMIXTURE WITH SYRUP.		
Syrupus		
Acaciæ, ...	Mucilage of Acacia.	Vehicle.
Acidi Citrici, . . .	Citric Acid.	Vehicle.
Ferri Iodidi, . .	Ferrous Iodide, 10 %.	Alterative, 0.9–1.9 C.c. (15 to 30 ♏).
Ferri, Quininæ et Strychninæ Phosphatum, .	Ferric Phosphate, 2 %. Quinine Sulphate, 3 %. Strychnine, 0.02 %.	Tonic, 3.7 C.c. (1 fl. dr.).
Hypophosphitum cum Ferro, . . .	Ferrous Lactate, 1 %; Syrup Hypophosphites.	Tonic, 3.7–7.5 C.c. (1 to 2 fl. dr.).
Krameriæ, ...	Fld. Ext. Krameria.	Astringent, 15 C.c. (½ fl. dr.).
Rhei, ...	Fld Ext. Rhubarb.	Laxative, 3.7 C.c. (1 fl. dr.).
Rhei Aromaticus, .	Arom. Tr. Rhubarb.	Purgative, 3.7 C.c. (1 fl. dr.).
Rosæ, ...	Fld. Ext. Rose.	Vehicle.
Rubi, ...	Fld. Ext. Rubus.	Astringent, 3.7–7.5 C.c. (1 to 2 fl. dr.).

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MELLITA—HONEYS.

What are Mellita or Honeys? Thick liquid preparations closely allied to syrups, differing merely in the use of honey as a base instead of syrup.

There are three official honeys:—

1. **Mel:** Commercial Honey. A saccharine secretion deposited in the honeycomb by Apis Mellifica. 2. **Mel Despumatum**; Clarified Honey. Commercial honey clarified by heating and straining. 3. **Mel Rosæ—12** Gm. Fld. Ext. Rose; Clar. Honey to 100 Gm.

MUCILAGINES—MUCILAGES.

What are Mucilagines or Mucilages? Thick, viscid, adhesive liquids, produced by dissolving gum in water, or by extracting with water the mucilaginous principles from vegetable substances.

1. WITHOUT HEAT.—(2). **Mucilago Acaciæ**—34 p. c. **Sassafras Medullæ**—2 p. c. Sas. Pith.

2. WITH HEAT.—(2). **Mucilago Tragacanthæ**—6 p. c.; (18 p. c. Glycerin). **Ulmi**—6. p. c. Boiling Water.

EMULSA, OR EMULSIONES—EMULSIONS.

What is an Emulsion? A soft, liquid preparation resembling milk, and consisting of an oily or resinous substance suspended in water by means of gum or mucilage.

Emulsions may be divided into three classes: Natural Emulsions, Gum-Resin and Seed Emulsions, and Oil or Artificial Emulsions.

1. NATURAL EMULSIONS. Those that exist ready formed in nature. Examples: milk, egg yolk, various plant juices, etc.

2. GUM-RESIN AND SEED EMULSIONS. The emulsions that result when asafetida, ammoniac, myrrh, etc., are triturated with water. The resinous and oily substances present are suspended in the water by the gummy matter present.

3. OIL OR ARTIFICIAL EMULSIONS. Two general methods for their preparation:—

1. *Continental Method.* Make a *nucleus* by triturating together oil 2 parts; powdered (*granulated*) acacia, 1 part; water 1½ parts *by weight.* When the oil is easy to emulsify the amount of acacia to oil may be reduced to 1–4. Directions: (1) Stir the oil with the gum in a dry mortar. Add the water immediately, all at once, and stir rapidly until a thick, creamy emulsion results, which is then diluted as desired; or (2) triturate the acacia with the water, add the oil at once, triturate to make nucleus; or (3) shake the oil and water together in a flask, and pour the mixture over the gum previously placed in a mortar, and triturate rapidly.

2. *English Method.* Make a thick mucilage of gum and water in a mortar, and to it add gradually and alternately the oil and water until the emulsion is completed.

Other emulsifying agents than acacia may be employed, such as tragacanth, yolk of egg, Irish moss, quillaja bark, extract of malt, casein, pancreatin, and gelatin. There are four official emulsions:—

Emulsum Ammoniaci (Emulsion of Ammoniac), [Mistura Ammoniaci, U. S., 1880]. Ammoniac, 4 p. c. Expectorant. Dose 15–30 C.c. (*ʒiv to ℥j*).

Emulsum Asafœtida (Emulsion of Asafetida). Asafetida, 4 p. c. Antispasmodic. Dose 15–30 C.c. (ʒiv to ℥j).

On triturating such fruits as the almond, etc., with water, an emulsion is obtained in which the oily matter present is suspended (emulsified) by means of the albuminous or gummy matter. Under this head is classed :

Emulsum Amygdalæ (Emulsion of Almond), [Mistura Amygdalæ, U. S., 1880. Milk of Almond]. Sweet Almond, 60 Gm. ; Acacia, 10 Gm. ; Sugar, 30 Gm. ; Water, q. s. to make 1000 C.c. Demulcent. Dose 60–200 C.c. (℥ij to ℥vj).

Emulsum Chloroformi (Emulsion of Chloroform), [Mistura Chloroformi, U. S. P., 1880]. Chloroform, 40 C.c. ; Exp. Ol. Almond, 60 C.c. ; Tragacanth, powd., 15 Gm. ; Water, q. s. to make 1000 C.c. Anodyne. Dose 15–20 C.c. (ʒiv to ʒv).

MISTURÆ—MIXTURES.

What are Misturæ, or Mixtures? Aqueous liquid preparations intended for internal use, which contain suspended insoluble substances. The term mixture is used rather indiscriminately.

There are four official mixtures, as follows :—

Title.	*Constituents.*	*Properties and Dose.*
MISTURA.		
Cretæ, (*Chalk Mixture*), ...	Comp. Chalk Powder, 200 Gm. ; Cinnamon Water, 400 C.c. ; Water, sufficient to make 1000 C.c.	Antacid, 15 C.c. (½ fl. oz.).
Ferri Composita (*Griffith's Mixture*). . .	Ferrous Sulphate, 6 Gm. ; Myrrh, 18 Gm. ; Sugar, 18 Gm. ; Potassium Carbonate, 8 Gm. ; Spirits Lavender, 60 C.c. ; Rose Water, sufficient to make 1000 C.c.	Tonic, 30–60 C.c. (1–2 fl. oz.).
Glycyrrhizæ Composita (*Brown Mixture*), ...	Ext. Liquorice, pure, 30 Gm. ; Syrup, 50 C.c. ; Mucilage Acacia, 100 C.c. ; Camphorated Tr. Opium, 120 C.c. ; Wine of Antimony, 60 C.c. ; Spirits of Nitrous Ether, 30 C.c. ; Water, sufficient to make 1000 C.c.	Expectorant, 15–30 C.c. (½–1 fl. oz.). Child 3.75 (1 fl. dr.)
Rhei et Sodæ, ...	Sodium Carbonate, 35 Gm. ; Fld. Ext. Rhubarb, 15 C.c. ; Fld. Ext. Ipecac, 3 C.c. ; Glycerin, 350 C.c. ; Spirit of Peppermint, 35 C.c. ; Water, sufficient to make 1000 C.c.	Carminative. Dose for child 1.9–3.75 C.c. (½–1 fl. dr.).

GLYCERITÆ—GLYCERITES.

What are Glyceritæ, or Glycerites? Mixtures or solutions of *medicinal substances* in glycerin.

There are six official glycerites, as follows :—

Title.	*Constituents.*	*Properties.*
GLYCERITUM.		
Glyceritum Amyli. *Glycerite of Starch,*	Starch and Water, of each 10 Gm.; Glycerin, 80 Gm.	Emollient, base, and Excipient.
Glyceritum Acidi Carbolici. (*Glycerite of Carbolic Acid*),	Carbolic Acid, 20 Gm.; Glycerin, 80 Gm.	Diluted as a wash.
Glyceritum Acidi Tannici. (*Glycerite of Tannic Acid*),	Tannic Acid, 20 Gm.; Glycerin, 80 Gm.	Local application, astringent.
Glyceritum Boroglycerini. (*Glycerite of Boroglycerin*),	Boric Acid, 310 Gm.; Glycerin, to make 1000 Gm.	Antiseptic.
Glyceritum Hydrastis. (*Glycerite of Hydrastis*),	Hydrastis, Water (Alcohol). Glycerin.	
Glyceritum Vitelli. (*Glycerite of Yolk of Egg*) [Glyconin],	Egg Yolk, 45 Gm.; Glycerin, 55 Gm.	Local application.

ALCOHOLIC SOLUTIONS.

SPIRITUS—SPIRITS.

What are Spiritus, or Spirits? Alcoholic solutions of volatile substances. They may be classified according to the method of preparation, as follows: 1. Solution in Alcohol: (a) simple solution; (b) with maceration. 2. Chemical Reaction and Solution. 3. Distillation.

There are twenty-five official spirits.

1. Spirits Prepared by Solution in Alcohol.—This class of spirits are prepared by dissolving the active ingredient in Alcohol. Maceration is also ordered for preparing Spirits Limonis, Menthæ Piperitæ, and Menthæ Viridis. Those made from volatile oils are frequently called *essences.*

SPIRITS PREPARED BY SOLUTION IN ALCOHOL.

Title.	*Constituents.*	*Properties and Dose.*
SPIRITUS.		
Ætheris,	Ether, 32.5 % vol.	Stimulant, 3.75–11.25 C.c. (1–3 fl. dr.).
Ætheris Compositus, (*Hoffmann's Anodyne*),	Ether, 32.5 % vol.; Ethereal Oil, 2.5 % vol.	Anodyne, 1–8 C.c. (¼–2 fl. dr.).
Ammoniæ,*	Gaseous Ammonia, 10 % wt.	Stimulant, 0.6–1.9 C.c. (10–30 ♏).
Ammoniæ Aromaticus,	Ammonia Carb.; Ammonia Water; Oils, Lemon, Lavender, Nutmeg.	Stimulant, 1.9–3.75 C.c. (¼–1 fl. dr.).
Amygdalæ Amaræ,	Oil, 1 % vol.	Flavor.
Anisi,	Oil, 10 % vol.	Flavor.

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* Some pharmacopœias recognize this under the title of Liquor Ammonii Caustici Spirituosus.

SPIRITS PREPARED BY SOLUTION IN ALCOHOL.—*Continued.*

Title.	*Constituents.*	*Properties and Dose.*
SPIRITUS.		
Aurantii, ...	Oil, 5 % vol.	Flavor.
Aurantii Compositus,	Oil, Orange, 20 % vol.; Oil, Lemon, 5 % vol.; Oil, Coriander, 2 % vol.; Oil, Anise, ½ % vol.	Flavor.
Camphoræ, ...	Camphor, 10 % wt.	Stimulant; Sedative, 0.3-3.75 C.c.(5 ♏-1 fl. dr.)
Chloroformi, ...	Chloroform, 6 % vol.	Sedative, 0.6–3.75 C.c. (10–60 ♏).
Cinnamomi, ...	Oil, 10 % vol.	Stimulant, 0.6–1.25 C.c. (10–20 ♏).
Gaultheriæ, ...	Oil, 5 % vol.	Flavor.
Glonoini, ...	$C_3H_5(NO_3)_3$ 1 % wt.	Cardiac Stimulant, 0.06-0.12 C.c. (1–2 ♏).
Juniperi, ...	Oil, 5 % vol.	Diuretic, 1.9–3.7 C.c. (30-60 ♏).
Juniperi Compositus,	Oil, Juniper, 0.4 % vol.; Oil, Caraway, 0.05 % vol.; Oil, Fennel, 0.05 % vol.	Diuretic, 7.5–15 C.c. (2–4 fl. dr.)
Lavandulæ, ...	Oil, 5 % vol.	Flavor.
Limonis, ...	Oil, 5 % vol.; Peel, 5 % wt.	Flavor.
Menthæ Piperitæ, . .	Oil, 10 % vol.; Herb, 1 % wt.	Carminative, 0.6–1.25 C.c. (10–20 ♏).
Menthæ Viridis, . .	Oil, 10 % vol.; Herb, 1 % wt.	Carminative, 1.9–2.5 C.c. (30–40 ♏).
Myrciæ, ...	Oil, Bay, 0.8 % vol.; Oil, Orange, 0.05 % vol.; Oil, Allspice, 0.05 % vol.	Perfume.
Myristicæ, ...	Oil, 5 % vol.	Flavor.
Phosphori, ...	Phosphorus, 0.12 % wt.	Basis for Elixir Phosphori.

2. **Spirits Prepared by Chemical Action and Solution.** The only one in the U. S. P. belonging to this class is *Spiritus Ætheris Nitrosi.* In its preparation ethyl nitrite is produced by the reaction between nitrous acid (derived from sodium nitrite) and alcohol; and this is preserved by solution in alcohol. Spts. æth. nit. should contain 4 p. c. ethyl nitrite. Diaphoretic, diuretic, and antispasmodic. Dose, 1.9–3.75 C.c. (ʒ ss–ʒ j).

3. **Spirits Prepared by Distillation.**—Besides the two mentioned below as belonging to this Class several of class 1 may be prepared by distillation with advantage.

SPIRITS PREPARED BY DISTILLATION.

Title.	*Constituents.*	*Properties and Dose.*
SPIRITUS.		
Frumenti, ...	Distillation of mash of fermented grain, and at least two years old.	44 % to 50 % wt. or 50 % to 58 % vol.
Vini Gallici, ...	Distillation of fermented juice of grapes, and at least four years old.	39 % to 47 % wt., or 46 % to 55 % vol.

ELIXIRIA—ELIXIRS.

What are Elixiria, or Elixirs? Elixirs are aromatic, sweetened, spirituous preparations, containing small quantities of active medicinal substances. There are two official elixirs:—

Elixir Aromaticum (Aromatic Elixir). Comp. Spts. Orange, 12 C.c.;

Syr., 375 C.c. (Prec. Calc. Phos., 15 Gm., for filtering); Deod. Alcohol, Dist. Water, of each q. s. to make 1000 C.c.

Elixir Phosphori (Elixir of Phosphorus). Spts. Phos., 210 C.c.; Ol. Anise, 2 C.c.; Glycerin, 550 C.c.; Aromat. Elix., q. s. ft. 1000 C.c.

ETHEREAL SOLUTIONS.

COLLODIA—COLLODIONS.

What are Collodia, or Collodions? Collodions are liquid preparations intended for external use, having for the base a solution of Pyroxylin, or gun-cotton, in a mixture of ether and alcohol. They leave a film on evaporation, which serves as a protection or an application of a medicinal ingredient to the skin. In the following description: P. = Pyroxylin; E. = Ether; A. = Alcohol.

There are four official collodions:—

Collodium (Collodion). 30 Gm. P.; 750 C.c. E.; 250 C.c. A.; decant the clear collodion from the sediment.

Collodium Cantharidatum (Cantharidal Collodion). 60 Gm. Canth.; 85 Gm. Flex. C.; chloroform, q. s. to exhaust Canth. and make 100 Gm.; after dist. should weigh 15 Gm.; decant the clear Canthar. Collod. from the sediment.

Collodium Flexile (Flexible Collodion). 920 Gm. Col.; 50 Gm. Canada Turpentine; 30 Gm. Castor Oil. To make 1000 Gm.

Collodium Stypticum (Styptic Collodion). 20 Gm. Tannic Acid; 5 C.c. A.; 25 C.c. E.; Col., q. s. ft. 100 C.c.

OLEAGINOUS SOLUTIONS, FOR EXTERNAL APPLICATION.

LINIMENTA—LINIMENTS, U. S. P.

(*From Coblentz's Handbook of Pharmacy.*)

Title.	*Base.*	*Constituents.*
LINIMENTUM		
Ammoniæ (Ammonia), ... (*Volatile Liniment*).	Cotton Seed Oil.	Ammonia Water, 350 C.c.; Alcohol, 50 C.c.; Cotton Seed Oil, 600 C.c.
Belladonnæ (Belladonna), ...	Fl'd Ext. Belladonna.	Camphor, 50 Gm.; Fl'd. Ext. Belladonna, to make 1000 C.c.
Calcis (Carron Oil),	Linseed Oil.	Solution Lime, Linseed Oil, equal parts.
Camphoræ (Camphor), ... :	Cotton Seed Oil.	Camphor, 200 Gm.; Cotton Seed Oil, 800 Gm.
Chloroformi (Chloroform), ...	Soap Liniment.	Chloroform, 300 C.c.; Soap Liniment, 700 C.c.
Saponis (Soap), . . .	Diluted Alcohol.	Soap (Powd), 70 Gm.; Camphor, 45 Gm; Oil Rosemary, 10 C.c.; Alcohol, 750 C.c.; Water to make 1000 C.c.
Saponis Mollis (Soft Soap), ...	Diluted Alcohol.	Soft Soap, 650 Gm.; Oil Lavender Flowers, 20 C.c.; Alchol, 300 C.c.; Water to make 1000 C.c.
Sinapis Compositum (Compound Mustard), ...	Alcohol.	Vol. Oil Mustard, 30 C.c.; Fl. Ext. Mezereum, 200 C.c.; Camphor, 60 Gm.; Castor Oil, 150 C.c.; Alcohol to make 1000 C.c.
Terebinthinæ (Turpentine), ...	Oil of Turpentine.	Resin Cerate, 650 Gm.; Oil Turpentine, 350 Gm.

OLEATA—OLEATES.

What are Oleata, or Oleates? The official Oleates are liquid preparations, made by dissolving metallic salts, or alkaloids, in oleic acid. They are not assumed to be definite chemical compounds.

There are three official oleates: **Oleatum Hydrargyri** (Oleate of Mercury). 200 Gm. Yel. Ox. Hg.; 800 Gm. Ol. Acid. **Oleatum Veratrinæ** (Oleate of Veratrum). 2 Gm. Veratrine; 98 Gm. Ol. Acid. **Oleatum Zinci** (Oleate of Zinc). Zn. Oxide 50 Gm.; Oleic Acid 950 Gm.

AQUEOUS LIQUIDS MADE BY PERCOLATION OR MACERATION.

INFUSA—INFUSIONS.

What are Infusa, or Infusions? Infusions are liquid preparations, made by treating vegetable substances with either hot or cold water. They are not boiled, though boiling water is often employed.

INFUSIONS—FOUR METHODS.

1. Prepared by Maceration.—*General Formula, U. S P.*—"An ordinary infusion, the strength of which is not directed by the physician, nor specified by the Pharmacopœia, shall be prepared by the following formula:—

"Take of—

The Substance, coarsely comminuted, fifty grammes, ...	50 Gm.
Boiling Water, 1000 cubic centimetres,	1000 C.c.
Water, a sufficient quantity,	
To make 1000 cubic centimetres, . .	1000 C.c.

"Put the substance into a suitable vessel provided with a cover, pour upon it the Boiling Water, cover the vessel tightly, and let it stand for half an hour. Then strain, and pass enough water through the strainer to make the infusion measure 1000 cubic centimetres.

"*Caution.*—The strength of infusions of energetic or powerful substances should be specially prescribed by the physician."

Various styles of infusion jars, pitchers, and mugs are described in Remington's "Practice of Pharmacy."

Infusion Digitalis (Infusion of Digitalis). Dig., 15 Gm.; Alcohol, 100 C.c.; Cin. Water, 150 C.c.; Boiling Water, 500 C.c.; Cold Water, q. s. ft. 1000 C.c.

Infusum Senna Compositum. (Compound Infusion of Senna) (Black Draught). 60 Gm. Senna; 120 Gm. Manna; 120 Gm. Mag. Sulph.; 20 Gm. Fennel; Boiling W., 800 C.c.; Cold W., q. s. ft. 1000 C.c.

2. By Digestion.—Let stand at a moderate heat below boiling. Very useful method, though it may not be directed in formula.

3. By Percolation.—Should be used whenever practicable.

Infusum Cinchonæ (Infusion of Cinchona). 60 Gm. Cinch.; 10 C.c. Arom. Sulph. Acid; Water, q. s. ft. 1000 C.c.

Infusum Pruni Virginianæ (Infusion of Wild Cherry). 40 Gm. *(No. 20 powd.)* Wild Cherry Bark; Water, q. s. to make 1000 C.c.

4. By Diluting Fluid Extracts.—"Improper and unjustifiable, except in those few cases in which the active and desirable principles of the drug are equally soluble in alcohol and in water, or in the menstruum used for both fluid extract and infusion."

DECOCTA—DECOCTIONS.

What are Decocta, or Decoctions? Decoctions are liquid preparations, made by *boiling* vegetable substances with water.

For description of various decoction vessels, see Remington's "Practice of Pharmacy."

General Official Formula.—"An ordinary decoction, the strength of which is not directed by the physician, nor specified by the Pharmacopœia, shall be prepared by the following formula:—

"Take of—

The Substance, coarsely comminuted, .	50 Gm.
Water, a sufficient quantity	
To make 1000 cubic centimetres, .	1000 C.c.

"Put the substance in a suitable vessel provided with a cover, pour upon it *1000 C.c.* of cold water, cover it well, and boil for fifteen minutes; then let it cool to about 40° C. (104° F.), strain the liquid, and pass through the strainer enough cold water to make the product measure *1000 C.c.*

"*Caution.*—The strength of decoctions of energetic or powerful substances should be specially prescribed by the physician."

Decoctum Cetrariæ (Decoction of Cetraria). 5 Gm. Cetraria; W., to 1000 C.c.

Decoctum Sarsaparillæ Compositum (Compound Decoction Sarsaparilla). Sar., 100 Gm.; Sas., 20 Gm.; Guaiac Wood, 20 Gm.; Glycyr., 20 Gm.; Mezereum, 10 Gm.; W., to make 1000 C.c.

ALCOHOLIC LIQUIDS MADE BY PERCOLATION OR MACERATION.

TINCTURÆ—TINCTURES.

What is a Tincture? A tincture is an alcoholic solution of a medicinal substance.

How does a Tincture differ from a Spirit? The latter, with one exception, are solutions of *volatile* substances in alcohol, while the former are of non-volatile substances.

By what processes may Tinctures be prepared? By *percolation*, *maceration*, *solution*, or *dilution*.

What menstrua are used in preparing them? Alcohol, diluted alcohol of various strengths, aromatic spirits of ammonia, or mixtures of alcohol, water, and glycerin.

Give an example of a Tincture made by solution or dilution. Tr. Iodine is an example. It is made by dissolving Iodine in alcohol.

Into what two general classes may Tinctures be divided? Into simple and compound Tinctures.

Why is Glycerin used in Tinctures? To prevent precipitation on standing.

There are seventy-one Official Tinctures, which may be classified according to percentage of active constituents as follows:—

SYLLABUS OF TINCTURES.

Official Title.	Per Cent. Active Con.	Constituents.	Menstruum.	Metric Dose.	English Dose.
Tinctura.					
Class 1.					
Opii Camphorata,	0.4	P. opium, benzoic acid, camphor, each 4 Gm., oil anise 4 C.c.	Dil. alcohol, glycerin.	0.3–15 C.c.	From 5 drops to 4 fl. dr.
Class 2.					
Nucis Vomicæ,	2	Ext. nux vomica, 20 Gm.	Alc. 3 p., water 1 p.	1.25 C.c.	20 minims.
Class 3.					
Cantharidis,	5	P. cantharides 50 Gm.	Alcohol.	0.09–0.30 C.c.	3 to 10 drops repeated 3 or 4 times a day.
Capsici,	5	P. capsicum 50 Gm.	Alc. 95 p., water 5 p.	1.9–3.75 C.c.	From ½ to 1 fl. dr.
Moschi,	5	Musk 50 Gm.	Dil. alcohol.	1.9–7.5 C.c.	From 30 ♏ to 2 fl. dr.
Strophanti,	5	P. strophanthus 50 Gm.	Alc. 65 p., water 35 p.	0.3–0.9 C.c.	From 5 to 15 ♏.
Class 4.					
Iodi,	7	Iodine 70 Gm.	Alcohol.	External.	
Class 5.					
Aloes,	10	Aloes 100 Gm., liquorice root 200 Gm.	Dil. alcohol.	0.3–15 C.c.	From 5 to 15 drops; as a purgative 3 to 4 fl. dr.; as a laxative ½ to 1 fl. dr.
Aloes et Myrrhæ,	10	Aloes 100 Gm., myrrh 100 Gm., liquorice root 100 Gm.	Alc. 75 p., water 25 p.	3.7–7.5 C.c.	From 1 to 2 fl. dr.
Arnica Radicis,	10	Arnica root 100 Gm.	Alc. 75 p., water 35 p.	1.25–1.9 C.c.	From 20 ♏ to half a fl. dr.
Bryoniæ,	10	Bryonia 100 Gm.	Alcohol.	3.7–7.5 C.c.	From 1 to 2 fl. dr.
Calumbæ,	10	Calumba 100 Gm.	Alc. 60 p., water 40 p.	3.7–15 C.c.	From 1 to 4 fl. dr.
Cardamomi,	10	Cardamon 100 Gm.	Dil. alcohol.	3.7 C.c.	1 fl. dr.
Catechu Composita,	10	Catechu 100 Gm., Cassia 50 Gm.	Dil. alcohol.	1.9–11.25 C.c.	From 30 ♏ to 3 fl. dr.
Chiratæ,	10	Chirata 100 Gm.	Alc. 65 p., water 35 p.	3.7–7.5 C.c.	1 to 2 fl. dr. 3 or 4 times a day.
Cinchonæ Composita,	10	Red cinchona 100 Gm., serpentaria 100 Gm., bit. orange peel 80 Gm.	Alc. 85 p., water 75 p., glycerin.	3.7–15 C.c.	1 to 4 fl. dr.
Cinnamomi,	10	Ceylon cinnamon 100 gm.	Alc. 75 p., w. 20 p., gly.	3.7–15 C.c.	From 1 to 3 or 4 fl. dr.
Croci,	10	Saffron 100 Gm.	Dil. alcohol.	3.7–11.25 C.c.	From 1 to 3 fl. dr.

Gentianæ Compositæ,	10	Gentian 100 Gm., bitter orange peel 40 Gm., Cardamon 100 Gm.	Alc. 60 p., water 40 p.	3.7–7.50 C.c.	1 or 2 fl. dr.
Kino,	10	Kino 100 Gm.	Alc. 65 p., w. 20 p., gly.	3.75 or 7.5 C.c.	1 or 2 fl. dr.
Matico,	10	Matico 100 Gm.	Dil. alcohol.	3.75 C.c.	1 fl. dr.
Opii,	10	P. opium 100 Gm. (calc. phos.).	Dil. alcohol.	0.65 C.c.	
Opii Deodorata,	10	P. op. 100 Gm. (ether—calc. phos.).	Alc. 20 p., water 80 p.	0.3–0.9 C.c.	22 drops or 11 ♏.
Quassiæ,	10	Quassia 100 Gm.	Alc. 35 p., water 65 p.	3.75 C.c.	1 fl. dr.
Rhei,	10	Rhub. 100 Gm, cardamon 20 Gm.	Alc. 60 p., w. 30 p., gly.	3.75–7.5 C.c.	From 1 to 2 fl. dr.
Rhei Dulcis,	10	Rhub. 100 Gm., liquorice 40 Gm., anise 40 Gm., cardamon 10 Gm.	Alc. 50 p., water 40 p., glycerin.	7.5–11.25 C.c.	From 2 to 3 fl. dr.
Serpentaria,	10	Serpentaria 100 Gm.	Alc. 65 p., water 35 p.	3.75–15 C.c.	1 to 4 fl. dr.
Sumbul,	10	Sumbul 100 Gm.	Alc. 65 p., water 35 p.	1.2–3.75 C.c.	From 20 ♏ to 1 fl. dr.
Tolutana,	10	Balsam tolu 100 Gm.	Alcohol.	3.75 or 7.5 C.c.	1 or 2 fl. dr.
Vanillæ,	10	Vanilla 100 Gm., sugar 200 Gm.	Alc. 65 p., water 35 p.	Flavor.	Flavor.
Class 6.					
Ferri Chloridi,	13.6	Sol. Fe_2Cl_6 250 C.c.	Alcohol.	0.6–7.5 C.c.	From 10 ♏ to 2 fl. dr.
Class 7.					
Belladonnæ Foliorum,	15	Belladonna lvs. 150 Gm.	Dil. alcohol.	0.9–1.9 C.c.	From 15 to drops.
Cannabis Indicæ,	15	Cannabis ind. 150 Gm.	Alcohol.	1.9 C.c.	About 50 drops.
Colchici Seminis,	15	Colchicum seed 150 Gm.	Alc. 60 p., water 40 p.	1.9–7.5 C.c.	½ to 2 fl. dr.
Digitalis,	15	Digitalis 150 Gm.	Dil. alcohol.	0.6–1.25 C.c.	From 10 to 20 drops.
Gelsemii,	15	Gelsemium 150 Gm.	Alc. 65 p., water 35 p.	0.6–1.25 C.c.	From 10 to 20 ♏.
Hyoscyami,	15	Hyoscyamus 150 Gm.	Dil. alcohol.	3.75 C.c.	1 fl. dr.
Physostigmatis,	15	Physostigma 150 Gm.	Alcohol.	1.25–2.5 C.c.	From 20 to 40 ♏.
Sanguinariæ,	15	Sanguinaria 150 Gm., acet. ac. 20 C.c.	Alc. 60 p., water 40 p.	1.9–3.75 C.c.	From 30 to 60 drops.
Scillæ,	15	Squill 150 Gm.	Alc. 75 p., water 25 p.	0.6–1.25 C.c.	From 20 to 40 drops.
Stramonii Seminis,	15	Stramonium seed 150 Gm.	Dil. alcohol.	1.25–1.9 C.c.	From 20 to 30 ♏.
Class 8.					
Arnicæ Florum,	20	Arnica flos. 200 Gm.	Dil. alcohol.	0.6–1.9 C.c.	From 10 to 30 ♏.
Asafœtidæ,	20	Asafœtida 200 Gm.	Alcohol.	1.9–3.7 C.c.	From 30 ♏ to 1 fl. dr.
Aurantii Amari,	20	Bitter orange peel 200 Gm.	Alc. 60 p., water 40 p.	3.7–7.5 C.c.	From 1 to 2 fl. dr.
Aurantii Dulcis,	20	Fresh sweet orange peel 200 Gm.	Alcohol.	Flavor.	
Benzoini,	20	Benzoin 200 Gm.	Alcohol.	1.25–1.9 C.c.	From 20 ♏ to ½ fl. dr.
Calendulæ,	20	Calendula 200 Gm.	Alcohol.	External.	
Cimicifugæ,	20	Cimicifuga 200 Gm.	Alcohol.	3.7–15 C.c.	From 1 fl. dr. to 4 fl. dr.
Cinchonæ,	20	Cinchona 200 Gm.	Alc. 67.5 p., w. 25 p., gly.	3.7–15 C.c.	From 1 to 4 fl. dr
Cubebæ,	20	Cubeb 200 Gm.	Alcohol.	3.7–7.5 C.c.	1 to 2 fl. dr.
Gallæ,	20	Nutgall 200 Gm.	Alcohol, glycerin.	3.7–11.25 C.c.	From 1 to 3 fl. dr.
Guaiaci,	20	Guaiac 200 Gm	Alcohol.	3.7 C.c.	1 teaspoonful 3 times a day.
Guaiaci Ammoniata,	20	Guaiac 200 Gm.	Sp. ammonia arom., *q. s.*	3.75–7.5 C.c.	1 to 2 fl. dr.

SYLLABUS OF TINCTURES.—*Continued.*

OFFICIAL TITLE.	PER CENT. ACTIVE CON.	CONSTITUENTS.	MENSTRUUM.	METRIC DOSE.	ENGLISH DOSE.
TINCTURA.					
Class 8.					
Humuli,	20	Hops 200 Gm.	Dil. alcohol.	3.7–11.25 C.c.	1 to 3 fl. dr.
Hydrastis,	20	Hydrastis 200 Gm.	Dil. alcohol.	1.9–3.75 C.c.	½ to 1 fl. dr.
Ipecacuanhæ et Opii,	20	Fl. ext. ipecac 100 C.c., deod. tinct. opium, 1000 C.c.	Dil. alcohol.	0.6 C.c.	10 minims.
Krameriæ,	20	Rhatany 200 Gm.	Dil. alcohol.	3.75–7.5 C.c.	1 or 2 fl. dr.
Lobeliæ,	20	Lobelia 200 Gm.	Dil. alcohol.	7.5 C.c.	2 fl. dr.
Myrrhæ,	20	Myrrh 200 Gm.	Alcohol.	0.9–1.9 C.c.	15 to 30 ♏.
Pyrethri,	20	Pyrethrum 200 Gm.	Alcohol.	External.	
Quillajæ,	20	Quillaja 200 Gm.	Alc. 35 p., water *q. s.*	External.	
Rhei Aromatica,	20	Rhub. 200 Gm., cinnamon, cloves, each 40 Gm., nutmeg 20 Gm.	Dil. alcohol, glycerin.	1.9–3.75 C.c.	½ to 1 fl. dr.
Valerianæ,	20	Valerian 200 Gm.	Alc. 75 p., water 25 p.	3.75–15 C.c.	1 to 4 fl. dr.
Valerianæ Ammoniata,	20	Valerian 200 Gm.	Sp. ammonia ar., *q. s.*	1.9–3.75 C.c.	30 ♏ to 1 fl. dr.
Zingiberis,	20	Ginger 200 Gm.	Alcohol.	0.5–2.5 C.c.	8 to 40 ♏.
Benzoini Composita,	20	Benzoin 120 Gm., Purif., Aloes 20 Gm., storax 80 Gm., tolu 40 Gm.	Alcohol.	1.9–7.5 C.c.	30 ♏ to 2 fl. dr.
Class 9.					
Aconiti,	35	Aconite root 350 Gm.	Alc. 70 p., water 30 p.	0.06–0.18 C.c.	1 to 3 drops.
Class 10.					
Veratri Viridis,	40	Veratrum viridi 400 Gm.	Alcohol.	0.06–0.18 C.c.	1 to 3 drops.
Cardamomi Composita,	40	Cardamon, cinnamon, each 20 Gm., caraway 10 Gm., cochineal 5 Gm.	Dil. alcohol, glycerin.	3.7–7.5 C.c.	1 or 2 fl. dr.
Lactucarii,	50	Lactucarium 500 Gm. (benzine).	Dil. alcohol, glycerin.		
Class 11.					
Lavandulæ Composita,	. .	Oil lavender fl. 8 C.c., Rosemary 2 C.c., cinnamon 20 Gm., cloves 5 Gm., nutmeg 10 Gm., red saunders 10 Gm.	Alc. 70 p., water 25 p., dil. alcohol.	1.9–3.75 C.c.	30 drops to 1 fl. dr.

TINCTURES OF RECENT PLANTS.

How would you prepare the U. S. P. Tincturæ Herbarum Recentium? "These tinctures, when not otherwise directed, are to be prepared by the following formula:—

Take of
The Fresh Herb, bruised or crushed, 500 grammes, or . . 500 Gm.
Alcohol, 1000 cubic centimetres, or . . . . 1000 C.c.

"Macerate the Herb with the alcohol for fourteen days, then express the liquid and filter (50 per cent. fresh herb)."

VINA MEDICATA—MEDICATED WINES.

What are Vina Medicata, or Medicated Wines? Medicated Wines are liquid preparations containing the soluble principles of medicinal substances dissolved in Wine.

What variety of Wine does the U. S. P. of 1890 recognize officially? The U. S. P. (1890), does not recognize any special variety of Wine, but only the general classes of white and red.

What amount of Alcohol should Wine contain? Ten to fourteen per cent.

What is the usual dose of Wine? About 3.7 to 15 C.c.,or 1 to 4 fl. dr.

Vinum Album (White Wine). "A pale, amber-colored or straw-colored liquid, having a pleasant odor, free from yeastiness, and a fruity, agreeable, slightly spirituous taste, without excessive sweetness or acidity.

Vinum Rubrum (Red Wine). Alcoholic liquid, made by fermenting the juice of fresh, colored grapes, the fruit of *Vitus Vinifera*, in presence of their skins. When Red Wine is prescribed without further specification, it is recommended that a dry Wine of domestic production (such as Native Claret, Burgundy, etc.) be employed.

There are eight Medicated Wines official in the U. S. P., as follows:

(*From Coblentz's "Handbook of Pharmacy."*)

Title.	*Active Constituents.*	*Properties.*	*Dose.*
VINUM, . .			
Antimonii,	Tartar-Emetic, 0.4 %.	Expectorant,	0.6–1.9 C.c. (10 to 30 dr.).
Colchici Radicis,	Colchicum Root, 40 %.	Diuretic,	0.6–3.75 C.c. (10 to 60 ♏).
Colchici Seminis,	Colchicum Seed, 15 %.	Diuretic,	1.9–7.5 C.c. (30 to 120 ♏).
Ergotæ, .	Ergot, 15 %.	Emmenagogue, Parturient,	7.5–11.25 C.c. (2 to 3 fl. dr.).
Ferri Amarum,	Cit. Iron and Quinine, 5 %.	Tonic,	7.5–15 C.c. (2 to 4 fl.dr.).
Ferri Citratis, . .	Cit.Iron and Ammonium, 4 %	Tonic,	3.75–15 C.c. (1 to 4 fl.dr.).
Ipecacuanhæ, .	Fl'd Ext. Ipecac, 10 %.	Expectorant,	0.6–1.9 C.c. (10 to 30 ♏).
Opii, . . .	Powd. Opium, 10 %.	Sedative,	0.9–1.25 C.c. (15 to 20 ♏).

EXTRACTA FLUIDA—FLUID EXTRACTS.

What are Fluid Extracts? Fluid extracts are liquid alcoholic preparations of nearly uniform and definite strength, made by percolating drugs with menstrua, and concentrating a portion of the percolate, so that in each case a cubic centimetre represents the medicinal virtue of one gramme of the drug; they are mostly concentrated tinctures.

What is the characteristic peculiarity of Fluid Extracts? They represent the activity of the drug, *volume* for *weight*, or one *minim* of fluid extract always represents about one *grain* of the drug from which it is prepared.

What is the difference in strength between the Fluid Extracts of 1870 and 1880–1890? The latter are about 5 per cent. weaker.

What great advantages do they possess over tinctures? They are uniform, definite, and concentrated.

What advantages do tinctures possess over Fluid Extracts? 1st. In some cases the alcohol menstruum of the tincture is to be desired. 2d. Tinctures may be added in small proportions to aqueous preparations, without serious precipitation.

Give the five principal methods of preparing Fluid Extracts now in use. 1. Percolation with partial evaporation (official). 2. Percolation with incomplete exhaustion. 3. Repercolation (Squibb). 4. Maceration with hydraulic pressure (Parke, Davis & Co.). 5. Vacuum maceration with percolation (Duffield).*

Give a Typical Formula for an official Fluid Extract. "100 grammes of the powdered drug are moistened with a certain quantity of menstruum, packed in a suitable percolator, and enough menstruum added to saturate the powder and leave a stratum above it; the lower orifice of the percolator is closed when the liquid begins to drop, and the percolator is closely covered to prevent evaporation and permit maceration for a specified time; additional menstruum is poured on, and percolation continued until the drug is exhausted. Usually from seven to nine-tenths of the first portion of the percolate is reserved, and the remainder evaporated at a temperature not exceeding 50° C. (122° F.) to a soft extract; this is to be dissolved in the reserved portion, and enough menstruum added to make the fluid extract measure 1000 C.c."—Remington.

Why is the latter portion of the percolate reserved and evaporated to a soft extract? The evaporation of the latter portion of the percolate permits concentration of the preparation without exposing the stronger portion to heat.

What is meant by Percolation with Incomplete Exhaustion? The modification of the official process is based upon the principle that the first seventy-five per cent. of the percolate contains seventy-five per cent. of drug. Acting under this assumption, the process is stopped here, and the fluid extract declared finished, and of full strength.

What is claimed in favor of this method? Saving of alcohol, and the use of heat. It is claimed that the wastage of alcohol comes from trying to recover the remaining 25 per cent. of the activity of the drug; and the use of heat is entirely obviated.

What is urged against the method? If percolation is properly conducted, the first 75 per cent. of the percolate probably does contain 75 per cent., or more, of the desired portions of the drug. But the official process, by carrying the percolation to complete exhaustion, insures against want of care and skill in conducting the operation, as the remaining activities are secured by the continuance of the percolation and final concentration.

There are eighty-eight official Fluid Extracts, which may be arranged in classes according to the alcoholic strength of their menstrua, as follows:—

**For a full description of the process of Squibb, Parke, Davis & Co., and S. P. Duffield, illustrated with cuts of* the apparatus employed, see Remington's "*Practice of Pharmacy.*"

OFFICIAL FLUID EXTRACTS

Arranged in Classes according to the Alcoholic Strength of their Menstrua, with Manipulative Notes.

NAME.	Number of C.c. used to Moisten.	MENSTRUUM.	Number of C.c. of Reserve.	PROCESS AND REMARKS.
Class 1.		Alcohol.		
Extractum Aromaticum Fluidum,	350	"	850	From Aromatic Powder. Percolate with the Menstruum directed until the drug is exhausted, reserving the number of C.c. set opposite each fluid extract in the proper column; evaporate or distil the rest of the percolate at a temperature not above 122° F. to a soft extract. Dissolve this in the reserved portion, and add sufficient alcohol to make the whole measure 1000 C.c.
Buchu,	400	"	850	
Calami,	350	"	950	
Cannabis Indicæ,	300	"	900	
Capsici,	500	"	900	
Cimicifugæ,	250	"	900	
Cubebæ,	200	"	900	
Cusso,	400	"	900	
Gelsemii,	300	"	900	
Grindeliæ,	300	"	850	
Iridis,	400	"	900	
Lupulini,	200	"	700	
Mezerei,	400	"	900	
Sabinæ,	250	"	900	
Veratri Viridis,	300	"	900	
Xanthoxyli,	250	"	900	
Zingiberis,	250	"	900	
Class 2.		Alcohol, 4. Water, 1.		
Belladonnæ Radicis,	350	"	900	Mix the alcohol and water, and exhaust the drug with the menstruum; reserve the number of C.c. directed, and distil or evaporate the remainder to a soft extract; add this to the reserved portion and sufficient menstruum to make the whole measure 1000 C.c.
Eriodictyi,	400	"	900	
Podophylli,	300	"	850	
Rhei,	400	"	750	
Serpentariæ,	300	"	900	
Class 3.		Alcohol, 3. Water, 1.		
Aconiti,	400	"	900	
Arnicæ Radicis,	400	"	900	
Calumbæ,	300	"	700	
Eucalypti,	400	"	900	
Guaranæ,	200	"	800	
Ipecacuanhæ,	350	"	900	
Leptandræ,	400	"	800	
Matico,	300	"	850	
Nucis Vomicæ,	1000	"		
Sanguinariæ,	300	"	850	With 5 p.c. ammonia water to menstruum, to dissolve Pectum.
Scillæ,	200	"	750	
Senegæ,	450	"	850	
Stramonii Seminis,	200	"	900	
Valerianæ,	300	"	850	
Viburni Opuli,	300	"	850	Having moistened the powder, exhaust with the menstruum, reserve the number of C.c. directed and distil or evaporate the remainder to a soft extract; add this to the reserved portion and sufficient menstruum to make the whole measure 1000 C.c.
Viburni Prunifolii,	300	"	850	
Class 4.		Alcohol, 2, Water, 1.		
Aurantii Amari,	350	"	800	
Chiratæ,	350	"	850	
Colchici Radicis,	350	"	850	
Colchici Seminis,	300	"	850	
Digitalis,	400	"	900	
Hyoscyami,	400	"	900	
Menispermi,	400	"	900	
Phytolaccæ,	400	"	800	

OFFICIAL FLUID EXTRACTS (*Continued*).

Name.	Number of C.c. used to Moisten.	**Menstruum.**	Number of C.c. of Reserve.	**Process and Remarks.**
Class 5.		Diluted Alcohol.		
Extractum Asclepiadis Fluidum,	400	“ “	900	With 2 p.c. acetic acid added to the menstruum to fix alkaloids.
Chimaphilæ,	400	“ “	700	
Cocæ,	450	“ “	800	
Conii,	300	“ “	900	
Convallariæ,	400	“ “	800	
Cypripedii,	350	“ “	850	With 2 p.c. acetic acid added to the menstruum to fix alkaloids.
Dulcamaræ,	400	“ “	800	
Ergotæ,	300	“ “	850	
Eupatorii,	400	“ “	800	
Gentianæ,	350	“ “	800	
Lappæ,	400	“ “	800	
Lobeliæ,	350	“ “	850	Exhaust the drug with the menstruum, and, having reserved the number of C.c. directed, distil or evaporate the remainder of the percolate to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the whole measure 1000 C.c.
Pilocarpi,	350	“ “	850	
Rhamni Purshianæ,	400	“ “	800	
Rumicis,	350	“ “	800	
Scoparii,	350	“ “	850	
Scutellariæ,	350	“ “	800	
Sennæ,	400	“ “	800	
Spigeliæ,	300	“ “	850	
Stillingiæ,	300	“ “	850	
Taraxaci,	300	“ “	850	
Class 6.		Alcohol, 50. Water, 80.		
Frangulæ,	350	“	800	
Class 7.		Alcohol, 1. Water, 2.		
Quassiæ,	400	“	900	
Sarsaparillæ,	400	“	800	
Class 8.		Alcohol, 30. Water, 65.		
Glycyrrhizæ,	350	“	750	With 5 p.c. ammonia water to hold in solution the Glycyrrhizin.
Class 9.		Containing Glycerin.		
Cinchonæ,	350	Glycerin, 20. Alcohol, 80.	750	Finish percolation with diluted alcohol.
Gossypii Radicis,	500	Glycerin, 25. Alcohol, 75.	700	Finish percolation with alcohol.
Pareiræ,	400	Glycerin, 10. Alcohol, 72. Water, 18.	850	Finish percolation with alcohol, 4; water, 1.
Apocyni,	400	Glycerin, 10 Alcohol, 65. Water, 25.	900	Finish percolation with alcohol, 65; water, 35.
Aspidospermatis,	400	Glycerin, 10. Alcohol, 60. Water, 30.	800	Finish percolation with alcohol, 2; water, 1.
Hydrastis,	300	Glycerin, 10. Alcohol, 60. Water, 30.	850	
Rubi,	350	Glycerin, 10. Alcohol, 60. Water, 30.	700	

OFFICIAL FLUID EXTRACTS (*Continued*).

NAME.	Number of C.c. used to Moisten.	MENSTRUUM.	Number of C.c. of Reserve.	PROCESS AND REMARKS.
Extractum Geranii,	350	Glycerin, 10. Dil. Alcohol.	700	Finish percolation with diluted alcohol.
Krameriæ,	400	Glycerin, 10. Dil. Alcohol.	700	
Rhois Glabræ,	350	Glycerin, 10. Dil. Alcohol.	800	
Rosæ,	400	Glycerin, 10. Dil. Alcohol.	750	
Hamamelidis,	350	Glycerin, 10. Alcohol, 50. Water, 80.	850	Finish percolation with alcohol, 8, water, 2.
Sarsaparilla Compositum,	400	Glycerin, 10. Alcohol, 30. Water, 60.	800	Finish percolation with alcohol, 1, water, 2.
Uvæ Ursi,	400	Glycerin, 30. Alcohol, 20. Water, 50.	900	Finish percolation with alcohol, 2, water, 5.
Pruni Virginianæ,	300	Glycerin, 10. Alcohol, 85. Water, 35.	800	Macerate with a mixture with 1 volume of glycerin and 2 volumes of water. Finish the percolation with a mixture of 17 volumes of alcohol and 3 volumes of water. Evaporate the weak percolate to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the whole measure 1000 C.c.
Class 10.		Boiling Water.		
Tritici,		" "		Percolate the triticum with boiling water until exhausted; evaporate to 750 C.c., add 250 C.c. alcohol, filter and add enough of a mixture of 1 volume of alcohol with 3 volumes of water to make the whole measure 1000 C.c.
Castaneæ,		" "		Macerate the castanea with boiling water, express; percolate residue to exhaustion; mix liquids; evaporate; when cool add alcohol, decant, filter remainder, evaporate united liquids to 700 C.c., add 100 C.c. glycerin and 200 C.c. alcohol.

"It will be seen that according to the U. S. Pharmacopœia of 1870, 3110.4 Gm. (100 troy ounces) of drug yielded 2956.4 C.c. (100 fluid ounces) of fluid extract, instead of 3110.4 C.c. as the present Pharmacopœia requires; hence there is a difference of 154 C.c. in the proportion of volume to drug, which renders our present fluid extracts about 5 per cent. weaker as compared with those based on troy weight *and fluidounces*, and which is certainly a point in their favor."—*Coblentz's Handbook of Pharmacy.*

ETHEREAL LIQUIDS MADE BY PERCOLATION.

OLEORESINÆ—OLEORESINS.

What are Oleoresinæ, or Oleoresins? The oleoresins are official liquid preparations, consisting principally of natural oils and resins extracted from vegetable substances by percolation with stronger ether. They are the strongest liquid preparations of drugs produced.

Give a general formula for their preparation. Percolate the powdered drug, in a cylindrical percolator provided with a cover and receptacle suitable for volatile liquids, with stronger ether, until exhausted, recovering the greater part of the ether by distillation, and exposing the residue, in a capsule, to spontaneous evaporation until the remaining ether has evaporated.

There are six official oleoresins:—

Title.	*Average Yield and Properties.*	*Dose.*
OLEORESINA.		
Aspidii, ...	About 16–18 %. Tænicide.	1.9–3.75 C.c. (30 to 60 ♏).
Capsici, ...	About 17–20 %. Stimulant, Rubefacient.	0.016–0.065 C.c. (¼ to 1 ♏).
Cubebæ, ...	About 18–22 %. Diuretic, Expectorant.	0.33–1.95 C.c. (5 to 30 ♏).
Lupulini, ...	About 55 %. Tonic, Sedative.	0.13–0.65 C.c. (2 to 10 ♏).
Piperis, ...	About 6–8 %. Stimulant.	0.016–0.065 C.c. (¼ to 1 ♏).
Zingiberis, . . .	About 5 %. Stimulant.	0.016–0.065 C.c. (¼ to 1 ♏).

ACETOUS LIQUIDS MADE BY PERCOLATION.

ACETA—VINEGARS.

What are Aceta, or Vinegars? Medicated vinegars are solutions of the active principles of drugs in diluted acetic acid, the latter being chosen as a menstruum because acetic acid is not only a good solvent, but also possesses antiseptic properties. Their use dates from the time of Hippocrates.

Acetic Acid is also of value as a menstruum, as it produces soluble salts with the alkaloidal principles existing in plants.

What menstruum is used for their preparation? The official diluted Acetic Acid, containing 6 p. c. by weight of absolute Acetic Acid.

There are two official vinegars:—

Acetum Opii (Vinegar of Opium) [Black Drop]. Opium 10 p. c. Sedative. Dose 0.3–1 C.c. (2 to 15 ♏).

Acetum Scillæ (Vinegar of Squill). 10 p. c. Squill. Expectorant. Dose 1–3 C.c. (¼ to ¾ fl. dr.).

SOLIDS.

SOLID PREPARATIONS MADE BY PERCOLATION OR MACERATION.

EXTRACTA—EXTRACTS.

What are Extracta, or Extracts? "Extracts are solid or semi-solid preparations, produced by evaporating solutions of vegetable substances."—(Remington.)

1. WITH ALCOHOLIC MENSTRUA (19).

General Formula.—"Percolate the powdered drug with the menstruum *directed, until it is* exhausted; reserve the first third of the percolate, and

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evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), until it weighs 10 p. c. of the weight of the drug. Mix this with the reserved portion, and evaporate both, at the above temperature, to a pilular consistence. Or, instead of reserving part of the percolate, the whole quantity is distilled until the alcohol is recovered, and the residue is evaporated to a pilular consistence. In the case of these extracts, which are apt to become hard, five p. c. of glycerin is added, to enable them to retain their consistence."

Directions for making Extract of Aconite, as directed by the U. S. Pharmacopœia, illustrating the method for manufacturing Alcoholic Extracts:—

Extractum Aconiti—Extract of Aconite.

Aconite, in No. 60 powder, 1000 grammes,	1000 grammes.
Alcohol, *a sufficient quantity.*	

Moisten the powder with *four hundred* (400) cubic centimetres of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding alcohol until three thousand cubic centimetres (3000) of tincture are obtained, or the aconite is exhausted. Reserve the first *nine hundred* cubic centimetres of the percolate, evaporate the remainder in a porcelain capsule, at a temperature not exceeding 50° C. (122° F.), to *one hundred* cubic centimetres, add the reserved portion, and evaporate at or below the above-mentioned temperature, until an extract of pilular consistency remains.

Rule in regard to yield: The more *aqueous* the menstruum, the greater is the yield of extract; the more *alcoholic* the menstruum, the smaller the yield.

Rule in regard to strength: This is not founded on amount of extract yielded by a given menstruum, but on amount of active constituents present in the finished product.

Solid extracts are prepared either—

(*a*) From the dried and powdered drug, by extraction with a solvent, or

(*b*) From the fresh, moist drug, by expression alone.

Two degrees of consistency recognized by U. S. P.—The soft, or pilular, and the hard extract. The latter admit of being reduced to powder.

There are thirty-two official Extracts which may be classed according to menstrua employed, as follows:—

I. ALCOHOLIC EXTRACTS.

Title.	*Dose Metric.* Grammes.	*Dose Eng.* Grains.
EXTRACTUM—		
Aconiti,	0.065–0.13	1–2
Cannabis Indicæ,	0.016 +	$\frac{1}{4}$ increasing.
Cimicifugæ,	0.194–0.648	3–10
Iridis,	0.065–0.13	1–2
Jalapæ,	0.65–1.3	10–20
Physostigmatis,	0.004–0.01	$\frac{1}{16}$–$\frac{1}{6}$

II. HYDRO-ALCOHOLIC EXTRACTS.

Title.	*Dose Metric.* Grammes.	*Dose Eng.* Grains.
EXTRACTUM—		
Arnicæ Radicis,	0.20–0.33	3–5
Belladonnæ Foliorum Alcoholicum,	0.010–0.021	1/6–1/3
Cinchonæ,	0.65–1.95	10–30
Colocynthidis,	0.03–0.1	1/2–1 1/2
Conii (with Acetic Acid),	0.03–0.065	1/2–1
Digitalis,	0.016	1/4
Ergotæ (with Acetic Acid),	0.33–1.9	5–30
Euonymi,	0.065–0.2	1–3
Hyoscyami,	0.065–0.13	1–2
Juglandis,	0.33–0.65	5–10
Leptandræ,	0.33–0.65	5–10
Nucis Vomicæ (with Acetic Acid),	0.016	1/4 gr. = 1/25 alc.
Podophylli,	0.065–0.2	1–3
Rhei,	0.03–0.65	5–10
Stramonii Seminis,	0.010–0.016	1/6–1/4
Uvæ Ursi,	1.9–3.75	30–60

III. AQUEOUS EXTRACTS.

Title.	*Dose Metric.* Grammes.	*Dose Eng.* Grains.
EXTRACTUM—		
Aloes,	0.13–0.65	2–10
Colchici Radicis (with Acetic Acid),	0.065–0.13	1–2
Gentianæ,	0.33–0.65	5–10
Glycyrrhizæ,		
Glycyrrhizæ Purum (with Ammonia Water),		
Hæmatoxyli,	0.65–1.95	10–30
Krameriæ,	0.65–1.3	10–20
Opii,	0.010–0.065	1/6–1
Quassiæ,	0.065–0.13	1–2
Taraxaci,	0.13–3.95	20–60

IV. COMPOUND EXTRACTS.

Title.	*Dose Metric.* Grammes.	*Dose Eng.* Grains.
EXTRACTUM—		
Colocynthidis Compositum,	0.3	

RESINÆ—RESINS.

What are Resinæ or Resins? The official resins are solid preparations, consisting principally of the resinous principles from vegetable bodies, prepared by precipitating them from their alcoholic solution with water.

There are four official resins:—

Resinæ Copaibæ (left after distilling off volatile oil). Dose 0.65–1.3 Gm. (10 to 20 gr.).

Jalapæ (pouring a tincture into water). Dose, 0.13–0.33 Gm. (2 to 5 gr.).

Podophylli (pouring a tincture into water acidulated with HCl). Dose 0.008–0.03 Gm. (1/8 to 1/2 gr.).

Scammonii (pouring a tincture, made by digesting Scammony in *boiling* alcohol, into water). Dose 0.26–0.52 Gm. (4 to 8 gr.).

SOLID PREPARATIONS MADE WITHOUT PERCOLATION OR MACERATION.

PULVERES—POWDERS.

There are nine official powders :—

Title.	*Constituents.*	*Properties and Dose.*
PULVIS		
Antimonialis (James' Powder).	Antimony Oxide, 33 Gm.; Ppt. Calc. Phos. 67 Gm.	Diaphoretic, Emetic, 0.2–0.52 Gm. (3 to 8 gr.).
Aromaticus.	P. Cinnamon, 35 Gm.; P. Ginger, 35 Gm.; P. Cardamon, 15 Gm.; P. Nutmeg, 15 Gm.	Aromatic.
Cretæ Compositus.	Prep. Chalk, 30 Gm.; Acacia, 20 Gm.; Sugar, 50 Gm.	For Chalk Mixture.
Effervescens Compositus (Seidlitz Powder).	Sodium Bicarb., 31 Gm.; Rochelle Salt, 93 Gm.; Tartaric Acid, 27 Gm.; Mix the Sod. Bicarb. and Roch. Salt, and divide into 12 pts. (blue papers.) Divide the T. Acid into 12 pts. (white papers.)	Laxative.
Glycyrrhizæ Compositus (Liquorice Powder).	P. Senna, 180 Gm.; P. Liquorice, 236 Gm.; Washed Sulphur, 80 Gm.; Oil Fennel, 4 Gm.; Sugar, 500 Gm.	Laxative, 2–8 Gm. (30 to 120 gr.).
Ipecacuanhæ et Opii (Dover's Powder).	P. Ipecac, 10 Gm.; P. Opium, 10 Gm.; Sugar of Milk, 80 Gm. Ten grains contain a grain each of the active constituents.	Diaphoretic, 0.3–1 Gm. (5 to 15 gr.).
Jalapæ Compositus.	P. Jalap, 35 Gm.; Potass. Bitart., 65 Gm.	Cathartic, 1–4 Gm. (15 to 60 gr.).
Morphinæ Compositus (Tully's Powder).	Morph. Sulph., 1 Gm.; P. Camphor, 19 Gm.; P. Liquorice, 20 Gm.; Precip. Calc. Carb., 20 Gm.	Diaphoretic, 0.3–0.9 Gm. (5 to 30 gr.).
Rhei Compositus.	P. Rhubarb, 25 Gm.; Magnesia, 65 Gm.; P. Ginger, 10 Gm.	Laxative, Antacid, 0.3–2 Gm. (½ to 60 gr.).

TRITURATIONES—TRITURATIONS.

What are Triturationes, or Triturations ? A new class of powders introduced into the U. S. P. of 1880, for the purpose of fixing a definite relation between the active ingredient and the diluent.

Give a general formula for their preparation, as directed by the U. S. P.

Take of—

	Definite Formula.
The Substance, 10 grammes, ...	10 Gm.
Sugar of Milk, in moderately fine powder, 90 grammes, ...	90 Gm.
To make 100 grammes, ...	100 Gm.

Weigh the Substance and Sugar of Milk separately; then place the

Substance, previously reduced, if necessary, to a moderately fine powder, in a mortar; add an equal bulk of Sugar of Milk, mix well by means of a spatula, and triturate them thoroughly together. Add fresh portions of the Sugar of Milk, from time to time, until the whole is added, and continue the trituration until the Substance is intimately mixed with the Sugar of Milk, and reduced to a fine powder.

There is one official trituration:—

Trituratio Elaterina. Elaterin, 10 Gm.; Sug. Milk, 90 Gm. Dose, 0.03–0.04 Gm. (½ to ⅝ gr.).

MASSÆ—MASSES.

What are Massæ, or Masses? Pill masses are official under this name. They are kept in bulk by pharmacists.

There are three official masses:—

Massa Copaibæ. 94 Gm. Cop.; 6 Gm. Mag. (recently prepared): mix intimately and set aside until it concretes. Dose 0.5–2 Gm. (8 to 60 grs.).

Ferri Carbonatis. 100 Gm. Sulph. Iron; 100 Gm. Carb. Sod.; 38 Gm. Clarif. Honey; 25 Gm. Sugar; syrup and distilled water, each q.s. Syrup is added to the ferrous sulphate solution and the wash water, to protect the ferrous salt against the absorption of oxygen. Boiling distilled water is employed to avoid the oxidizing action of the air which is contained in the unboiled water." (Coblentz.) Dose 0.2–0.5 Gm. (3 to 5 gr.).

Hydrargyri. 33 Gm. Hg.; 5 Gm. Glycyrr.; 25 Gm. Althæa; 3 Gm. Glycerin; Honey of Rose, 34 Gm. Triturate the Hg with Honey of Rose and Glycerin until it is extinguished. Add, gradually the Glycyrrhiza and Althæa, and continue trituration till globules of Hg cease to be visible. Dose 0.02–0.05 Gm. (3 to 8 gr.).

CONFECTIONES—CONFECTIONS.

What are Confectiones, or Confections? Confections are saccharine, soft solids, in which one or more medicinal substances are incorporated, with the object of affording an agreeable form for their administration and a convenient method for their preservation. Old names, *conserves* and *electuaries*, under which they have been in use for centuries.

There are two official confections:—

Confectio Rosæ.—R. Rose, 80 Gm.; P. Sugar, 640 Gm.; Clar. Honey, 120 Gm.; Rose W., 160 Gm.

Sennæ.—Sen., 100 Gm.; Ol. Coriander, 5 Gm.; Cas. Fist., 160 Gm.; Tamarind, 100 Gm.; Prune, 70 Gm.; Fig, 120 Gm.; P. Sug., 555 Gm.; Water, to make 1000 Gm.

PILULÆ—PILLS.

What are Pilulæ, or Pills? "Pills are small, solid bodies, of a globular, ovoid, or lenticular shape, which are intended to be swallowed, and thereby produce medical action.—(Remington.)

Of what is a pill mass composed, and what is required of it? It is composed of ingredients and excipients. It is required that the mass be 1, *adhesive*; 2, *firm*; 3, *plastic*.

How are excipients divided? Give a list of the principal excipients and directions when they should be used. Excipients are *liquid or solid.*

LIQUID EXCIPIENTS.

1. Water; use only when ingredients possess inherent adhesiveness that water will develop.

2. Syrup: adhesive.

3. Syrup Acacia: more adhesive.

4. Mucilage Acacia: most adhesive. Pills are liable to become hard and insoluble if acacia in any form is used as excipient.

5. Glycerin: somewhat adhesive. It is hygroscopic and keeps pills soft.

6. Glucose: very adhesive. Colorless, and non-volatile at ordinary temperature. Very valuable.

7. Honey: Good substitute for glucose, but colors white pills.

8. Extract of Malt: advantages of glucose, but possesses the disadvantage of dark color.

9. Glycerite of Starch: Glycerin—adhesiveness of starch and jelly. Thickness sometimes an objectionable feature.

10. Glycerite of Tragacanth: Similar to above.

11. Remington's general excipient: Glucose, 4 oz. av.; Glycerin, 1 oz. av.; Acacia (pulv.), 90 grains; Benzoic Acid, 1 grain. Dissolve benzoic acid in the glycerin, stir in acacia, then the glucose, and let stand till dissolved. *Moderate* heat may be used.

SOLID EXCIPIENTS.

1. Confection of Rose: Useful when it is desired to dilute active ingredients and increase bulk.

2. Bread Crumb: Used in making pills to contain croton oil, volatile oils, etc.

3. Powdered Althæa: too bulky for ordinary use.

4. Soap: valuable for resinous substances. Not only makes excellent mass, but increases the solubility of resins.

5. Resin Cerate: for oxidizable substances, resins, etc.

6. Cacao Butter: for pills of permanganate of potassium, etc.

7. Petrolatum: for oxidizable substances as above.

How would you divide the mass? On a graduated pill tile, or a pill machine. The former is made of porcelain, but preferably of plate glass. In either case the pill-mass is rolled into a cylinder. In the former the mass is divided into the required number of portions with a spatula. In the latter it is divided by laying it upon the grooves of the lower board in the pill machine; the upper board is applied so that the cutting surfaces correspond with those on the lower board, and "by a slight backward and forward motion, with downward pressure, the mass is divided."

How would you finish pills and keep them from adhering together? Finish them either by rolling between the thumb and finger, or rotate them under an adjustable pill finisher. To prevent them from adhering together, dust with rice flour, powdered magnesium carbonate, lycopodium, powdered althæa, or powdered liquorice root.

How may pills be coated? Pills may be coated with various substances. With *gold* or *silver*, "by first placing a drop of syrup of acacia in a mortar, and after carefully spreading it over the surface with the end of the finger, dropping in the pills, rotating them so that they shall be uniformerly coated with a very thin layer of mucilage, and then dropping them into the gold or silver leaf contained in the coater—"a smooth, globular box, opening in the middle." An ordinary pill box will answer the purpose. With *gelatin*, by a simply constructed machine, in which the pills, arranged automatically in rows, are impaled on a system of pins, afterward dipped in a hot solution of gelatin, twirled gently until the coating is set, and rapidly dried by rotating on a wheel, after which they are removed from the pins. This can be accomplished in fifteen minutes. With *sugar*, by rotating them with a mixture of sugar and starch in a pill coater, which consists of a caldron-shaped copper vessel, revolving at an incline, and heated by steam. The process can only be accomplished economically on the large scale.

How are compressed pills manufactured? On the small scale, by Remington's compressed pill machine. It is made of cast steel, and has at the base two countersunk depressions, with a short post in the centre of each; a lenticular depression is made in the upper surface of each post. Steel cylinders fit over the posts, and plungers fit in the cylinders, with lenticular depressions to correspond with those on the posts. The powder is compressed into pills between the lenticular surfaces by blows on the plungers with a mallet; the pills are removed by lifting the cylinders. On the large scale by power presses, working on a similar principle.

There are fifteen official pills:—

Title.	*Constituents.*	*Dose.*
PILULÆ.		
Aloes.	Aloes and Soap, each 13 Gm., in 100 pills.	As a laxative, 1, 2, or 3 pills at bedtime; as a purge, 5 pills.
Aloes et Asafœtidæ.	Aloes, Asafetida, and Soap, each 9 Gm., in 100 pills.	From 2 to 5 pills.
Aloes et Ferri.	Aloes Dried Sulph. Iron, and Aromat. Powder, each 7 Gm.; Confect. Rose, q. s., in 100 pills.	1 to 3 pills.
Aloes et Mastiches (Aloes and Mastic. Lady Webster Dinner Pills).	Aloes, 13 Gm.; Mastic, 4 Gm.; Red Rose, 3 Gm.; in 100 pills.	One of them may be given as a laxative at bedtime or before a meal.
Aloes et Myrrhæ.	Aloes, 13 Gm.; Myrrh, 6 Gm.; Aromat. Powd., 4 Gm.; Syrup, q. s., 100 pills.	From 3 to 6 pills.
Antimonii Compositæ (Plummer's Pills).	Sulphurated Ant., 4 Gm.; Calomel, 4 Gm.; Guaiac., 8 Gm.; Castor Oil, q. s., 100 pills.	1 to 2 pills or more may be given morning and evening.
Asafœtidæ.	As., 20 Gm.; Soap, 6 Gm.; 100 pills.	
Catharticæ Compositæ.	Ext. Col. Comp., 80 Gm.; Calomel, 60 Gm.; Jalap (extract), 30 Gm.; Gamboge, 15 Gm.; 1000 pills.	3 of the pills are a medium dose for an adult.
Catharticæ Vegetabilis.	Ext. Col. Comp., 60 Gm.; Ext. Hyoscyam., 30 Gm.; Ext. Jalap, 30 Gm.; Ext. Leptandra, 15 Gm.; Resin Podophyllum, 15 Gm.; Oil of Peppermint, 8 C.c.; in 1000 pills.	3 pills, and they may be given in place of compound cathartic pills.

Title.	*Constituents.*	*Dose.*
PILULÆ.		
Ferri Carbonatis (Ferruginous Pills, Chalybeate Pills. Biaud's Pills.	Ferrous Sulphate, 16 Gm.; Potass. Carb., 8 Gm.; Sugar, 4 Gm.; Tragacanth, 1 Gm.; Althæa, 1 Gm.; Glycerin, q. s., in 100 pills.	2 to 6 pills—3 times a day.
Ferri Iodidi.	Reduced Iron, 4 Gm.; Iodine, 5 Gm.; P. Glycyrr., 4 Gm.; Sugar, 4 Gm.; Ext. Glycyrr., 1 Gm.; Acacia, 1 Gm.; q. s. each Water, Bals., Tolu, and Ether. (See U. S. P.)	
Opii.	Opium, 6.5 Gm.; Soap, 2.0 Gm.; 100 pills.	1 pill.
Phosphori.	Phos., 0.06 Gm.; Althæa, 6.00 Gm.; Acaciæ, 6.00 Gm.; Phosphorus dissolved in 5 C.c. Chloroform, and made into a pill with about 4 C.c. of a mixture of 2 vol. Glycerin, 1 vol. Water. Coated with 10 Gm. Bals. Tolu dissolved in 15 C.c. Ether.	1 pill—3 times a day.
Rhei.	Rhubarb, 20 Gm.; Soap, 6 Gm., in 100 pills.	1 or 2 pills.
Rhei Compositæ.	Rhubarb, 13 Gm.; Aloes, 10 Gm.; Myrrh, 6 Gm.; Ol. Pep., 0.5 Gm., in 100 pills.	2 to 4 pills twice a day.

TROCHISCI—TROCHES.

What are Trochisci, or Troches? Troches, or lozenges, are solid, discoid, or cylindrical masses, consisting chiefly of medicinal powders, sugar, and mucilage. They are prepared by making the ingredients into a mass which is rolled into a thin sheet, and cut into proper shape with a lozenge cutter.

TABLE OF TROCHES.

(*From Coblentz's "Handbook of Pharmacy."*)

The U. S. Pharmacopœia recognizes 15 formulas for Troches.

Title.	*Constituents—100 Troches.*	*Each Troche contains*
TROCHISCI		
Acidi Tannici.	Tannic Acid, 6 Gm.; Sugar, powd., 65 Gm.; Tragacanth, powd., 2 Gm.; Stronger Orange Flower Water, a sufficient quantity.	Tannic Acid, 0.06 Gm. (1 gr.)
Ammonii Chloridi.	Ammonium Chloride, 10 Gm.; Extract of Liquorice, 25 Gm.; Tragacanth, powd., 2 Gm.; Sugar, powd., 50 Gm.; Syrup of Tolu, a sufficient quantity.	Ammonium Chloride, 0.1 Gm. (2 gr.)
Catechu.	Catechu, 6 Gm.; Sugar, powd., 65 Gm.; Tragacanth, 2 Gm.; Stronger Orange Flower Water, a sufficient quantity.	Catechu, 0.06 Gm. (1 gr.)
Cretæ.	Prepared Chalk, 25 Gm.; Acacia, 7 Gm.; Spirit of Nutmeg, 3 C.c.; Sugar, powd., 40 Gm.; Water, a sufficient quantity.	Prepared Chalk, 0.25 Gm. (4 gr.)
Cubebæ.	Oleoresin of Cubeb, 4 Gm.; Oil of Sassafras, 1 C.c.; Extract of Liquorice, 25 Gm.; Acacia, powd., 12 Gm.; Syrup of Tolu, a sufficient quantity.	Oleoresin Cubeb, 0.04 Gm. (¾ gr.)
Ferri.	Ferric Hydrate, 30 Gm.; Vanilla, cut, 1 Gm.; Sugar, powd., 100 Gm.; Mucilage of Tragacanth, a sufficient quantity.	Ferric Hydrate, 0.03 Gm. (½ gr.)

TABLE OF TROCHES.—*Continued.*

Title.	*Constituents—100 Troches.*	*Each Troche contains*
TROCHISCI.		
Glycyrrhizæ et Opii.	Extract of Liquorice, 15 Gm.; Powd. Opium, 0.5 Gm.; Acacia, powd., 12 Gm.; Sugar, powd., 20 Gm.; Oil of Anise, 0.2 C.c.; Water, a sufficient quantity.	P. Opium, 0.005 Gm. (⅛ gr.)
Ipecacuanhæ.	Ipecac, powd., 2 Gm.; Tragacanth, powd., 2 Gm.; Sugar, powd., 65 Gm.; Syr. of Orange, a sufficient quantity.	P. Ipecac, 0.02 Gm. (¼ gr.)
Krameriæ.	Extract of Krameria, 6 Gm.; Sugar, powd., 65 Gm.; Tragacanth, powd., 2 Gm.; Stronger Orange Flower Water, a sufficient quantity.	Ext. Krameria, 0.06 Gm. (1 gr.)
Menthæ Piperitæ.	Oil of Peppermint, 1 C.c.; Sugar, powd., 80 Gm.; Mucilage of Tragacanth, a sufficient quantity.	Oil of Peppermint, 0.01 C.c. (⅛ gr.)
Morphinæ et Ipecacuanhæ.	Morphine Sulphate, 0.16 Gm.; Ipecac, powd., 0.5 Gm.; Sugar, powd., 65.00 Gm.; Oil of Wintergreen, 0.2 C.c.; Mucilage of Tragacanth, a sufficient quantity.	Morphine Sulphate, 0.0016 Gm.; P. Ipecac, 0.005 Gm. (1/10 gr.)
Potassii Chloratis.	Potassium Chlorate, 30 Gm.; Sugar, powd., 120 Gm.; Tragacanth, powd., 6 Gm.; Spirit of Lemon, 1 C.c.; Water, a sufficient quantity.	Potassium Chlorate, 0.03 Gm. (½ gr.)
Santonini.	Santonin, 3 Gm.; Sugar, powd., 110 Gm.; Tragacanth, powd., 3 Gm.; Stronger Orange Flower Water, a sufficient quantity.	Santonin, 0.03 Gm. (½ gr.)
Sodii Bicarbonatis.	Sodium Bicarbonate, 20 Gm.; Sugar, powd., 60 Gm.; Nutmeg, bruised, 1 Gm.; Mucilage of Tragacanth, a sufficient quantity.	Sodium Bicarbonate, 0.02 Gm. (¼ gr.)
Zingiberis.	Tinct. Ginger, 20 C.c.; Tragacanth, powd., 4 Gm.; Sugar, powd., 130 Gm.; Syr. of Ginger, a sufficient quantity.	Tincture of Ginger, 0.02 C.c. (¼ gr.)

SOLID PREPARATIONS FOR EXTERNAL USE.

CERATA—CERATES.

What are Cerata, or Cerates? Cerates are unctuous substances of such consistency that they may be easily spread, at ordinary temperatures, upon muslin or similar material, with a spatula, and yet not so soft as to liquefy and run when applied to the skin.

Why are they called cerates? Owing to the presence of wax (Cera).

What substances are used for bases? Oil, lard, petrolatum. Wax, and sometimes paraffin or spermaceti, in the presence of wax, are used to raise the melting point of the bases.

There are six official cerates. Two classes:—

Title.	*Composition.*
Ceratum (Simple Cerate), .	White Wax, 300 Gm.; Lard, 700 Gm.
Ceratum Camphoræ, . . .	Camphor Liniment, 100 Gm.; White Wax, 300 Gm.; Lard, 600 Gm.
Ceratum Cantharidis (Blistering Cerate), ...	Cantharides pulv., 320 Gm.; Yellow Wax, 180 Gm.; Resin, 180 Gm.; Lard, 220 Gm.; Oil of Turpentine, 150 C.c.
Ceratum Cetacei (Spermaceti Cerate), ...	Spermaceti, 100 Gm.; White Wax, 350 Gm.; Olive Oil, 550 Gm.
Ceratum Plumbi Subacetatis, ...	Solution of Lead Subacetate, 200 Gm.; Camphor Cerate, 800 Gm.
Ceratum Resinæ (Basilicon Ointment), ...	Resin, 350 Gm.; Yellow Wax, 150 Gm.; Lard, 500 Gm.

UNGUENTA—OINTMENTS.

What are Unguenta, or Ointments? Ointments are fatty preparations, of a softer consistence than cerates, intended to be applied to the skin by inunction.

Title.	*Per Cent. of Active Constituent.*	*Base.*
UNGUENTUM,	Lard, 80 %; Yellow Wax, 20 %.	
Acidi Carbolici,	Carbolic Acid, 5 %.	Unguentum.
Acidi Tannici,	Tannic Acid, 20 %.	Benz. Lard.
Aquæ Rosæ,	. . . .	Spermaceti, White Wax, Exp. Oil Almond, Stronger Rose Water, Sodium Borate.
Belladonnæ,	Ext. Belladonna Leaves, 10 %.	Benz. Lard.
Chrysarobini,	Chrysarobin, 5 %.	Benz. Lard.
Diachylon,	. . . .	Lead Plaster, Olive Oil, Oil Lavender fl.
Gallæ,	Nutgall, 20 %.	Benz. Lard.
Hydrargyri,	Mercury, 50 %.	Lard and Suet.
Hydrargyri Ammoniati,	Ammoniated Mercury, 10 %.	Benz. Lard.
Hydrargyri Nitratis,	Mercuric Nitrate about 12½ %.	Lard Oil.
Hydrargyri Oxidi Flavi,	Yellow Mercuric Oxide, 10 %.	Unguentum.
Hydrargyri Oxidi Rubri,	Red Mercuric Oxide, 10 %.	Unguentum.
Iodi,	Iodine, 4 % (with KI).	Benz. Lard.
Iodoformi,	Iodoform, 10 %.	Benz. Lard.
Picis Liquidæ,	Tar, 50 %.	Yellow Wax and Lard.
Plumbi Carbonatis,	Lead Carbonate, 10 %.	Benz. Lard.
Plumbi Iodidi,	Lead Iodide, 10 %.	Benz. Lard.
Potassii Iodidi,	Potassium Iodide, 12 %.	Benz. Lard.
Stramonii,	Ext. Stramonium Seed, 10 %.	Benz. Lard.
Sulphuris,	Washed Sulphur, 30 %.	Benz. Lard.
Veratrinæ,	Veratrine, 4 %.	Benz. Lard.
Zinci Oxide,	Zinc Oxide, 20 %.	Benz. Lard.

EMPLASTRA—PLASTERS.

What are Emplastra, or Plasters? Plasters are substances intended for external application, of such consistence that they adhere to the skin, and require the aid of heat in spreading them.

On what are plasters usually spread? Plasters are usually spread on muslin, leather, paper, etc., and have as a basis, lead plaster, a gum-resin, or Burgundy pitch.

As plasters are usually bought of the manufacturer, ready-made, a description of the process for spreading them is omitted.

There are seventeen official plasters. Four classes:—

PLASTERS CONTAINING EMPLASTRUM PLUMBI AS BASE.

Title.	*Constituents.*
EMPLASTRUM	
Ferri,	Ferric Hydrate, 90 Gm.; Olive Oil, 50 Gm.; Burgundy Pitch, 140 Gm.; Lead Plaster, 720 Gm.
Hydrargyri.	Mercury, 300 Gm.; Oleate of Mercury, 12 Gm.; Lead Plaster, sufficient quantity, to make 1000 Gm.
Opii,	Ext. Opium, 60 Gm.; Burgundy Pitch, 180 Gm.; Lead Plaster, 760 Gm.; Water, 80 Gm.
Plumbi,	Lead Oxide, 3200 Gm.; Olive Oil, 6000 Gm.; Water, sufficient quantity.
Resinæ,	Resin, 140 Gm.; Lead Plaster, 800 Gm.; Yellow Wax, 60 Gm.
Saponis,	Soap, 100 Gm.; Lead Plaster, 900 Gm.; Water, sufficient quantity.

PLASTERS—RESINOUS.

EMPLASTRUM	
Ammoniaci cum hydrargyro, ...	Ammoniac, 720 Gm.; Mercury, 180 Gm.; Oleate of Mercury, 8 Gm.; Dilute Acetic Acid, 1000 C.c.; Lead Plaster, sufficient quantity.
Arnicæ, ...	Ext. Arnica Root, 330 Gm.; Resin Plaster, 670 Gm.
Belladonnæ, ...	Alc. Ext. Belladonna Lvs., 200 Gm.; Resin Plaster, 400 Gm.; Soap Plaster, 400 Gm.
Picis Burgundicæ, . . .	Burgundy Pitch, 800 Gm.; Olive Oil, 50 Gm.; Yellow Wax, 150 Gm.
Picis Cantharidatum, . .	Cantharidis Cerate, 80 Gm.; Burgundy Pitch, to make 1000 Gm.

PLASTERS—SPREAD.

EMPLASTRUM	
Capsici, ...	Oleoresin of Capsicum; Resin Plaster.
Ichthyocollæ, ...	Isinglass, 10 Gm.; Alcohol, 40 Gm.; Glycerin, 1 Gm.; Water, and Tincture of Benzoin, each, sufficient quantity.

CHARTA—PAPERS.

What are Charta, or Papers? Papers are a small class of preparations intended for external application, made either by saturating paper with medicinal substances, or by applying the latter to the surface of the paper by the addition of some adhesive liquid.

There are two official papers:—

Charta Potassii Nitratis.—Nit. Potas. 20 Gm.; Dist. Water 80 C.c. Immerse strips of white, unsized paper in the solution, and dry them. **Charta Sinapis.**—Black Mustard, 100 Gm.; India Rubber, 10 Gm.; Benzin, Carbon Disulphide, of each q. s. Percolate Mustard with Benzin, to rid it of fixed oil; dry. Dissolve India Rubber in mixture of 100 C.c. each, Benzin and Carbon Disulphide; make semi-liquid magma with mustard. Brush on rather stiff, well-sized paper. Each 60 sq. cent. of paper should contain about 4 Gm. black mustard deprived of oil.

SUPPOSITARIA—SUPPOSITORIES.

What are Suppositories? Suppositories are solid bodies intended to be introduced into the rectum, urethra, or vagina, to produce medicinal action.

What are the requirements in preparing them? They should be prepared of materials of sufficient consistency to retain their shape when inserted, and, at the same time, melt at the temperature of the body. Butter of cacao fulfils the requirements. Only in the hottest summer weather should its melting point be raised by the addition of spermaceti or wax unless some softening ingredient is used in making the suppositories.

How are Gelatin Suppositories prepared? Gelatin suppositories are made from a mass containing gelatin and glycerin, by soaking gelatin in water, draining off the excess, adding five parts, by weight, of glycerin to every twelve parts of soft gelatin, and heating in a water-bath. The medicating substance is rubbed into a smooth paste with a small quantity of water or glycerin, and added to the mass.

By what three methods are Suppositories shaped? By *rolling*, *moulding*, and *pressing*.

Describe the method for performing each operation.

1. *Rolled Suppositories* are made by incorporating the medicinal substance with grated cacao butter in a mortar, with a pestle, until the mixture becomes a mass. The mass is now rolled into a cylinder on a pill tile,

thoroughly dusted with lycopodium, and cut into the desired lengths, which are then made into a conical form by rolling one end on the tile with a spatula, so as to produce a rounded point.

2. *Moulded Suppositories.*—The U. S. P. directs that they shall be made in the following manner: Mix the medicinal portion (previously brought to a proper consistence, if necessary) with a small quantity of Oil of Theobroma, by rubbing them together, and add the mixture to the remaining Oil of Theobroma, previously melted and cooled to the temperature of 35° C. (95° F.). Then mix thoroughly, without applying more heat, and immediately pour the mixture into suitable moulds. The moulds must be kept cold by being placed on ice or by immersion in ice cold water before the melted mass is poured in. In the absence of suitable moulds, suppositories may be formed by allowing the mixture, prepared as above, to cool, care being taken to keep the ingredients well mixed, and dividing the mass into parts of a definite weight each, of the proper shape.

What weights and shapes are directed by the U. S. P.? Unless otherwise specified, suppositories should have the following weights and shapes, corresponding to their several uses:—

Rectal suppositories should be cone-shaped, and of a weight of about 1 Gm.

Urethral suppositories should be pencil-shaped, and of a weight of about 1 gramme.

Vaginal suppositories should be globular, and of a weight of about 3 Gm.

3. *Pressing.*—This is usually accomplished by pressing the mass through a cylinder into a mould, without heat. Unsatisfactory.

How many Suppositories are official in the U. S. P.? One, Suppositoria Glycerini.

Give Formula and Directions for making it. Take of Glycerin, 60 Gm.; of Sodium Carbonate, 3 Gm.; Stearic Acid, 5 Gm.; to make 10 rectal suppositories. Dissolve the Sodium Carbonate in the Glycerin in a capsule on a water-bath, then add the stearic acid, and heat carefully until this is dissolved, and the escape of carbonic acid gas has ceased. Then pour the melted mass into suitable moulds, remove the suppositories when they are cold, and wrap each in tin-foil. These suppositories should be freshly prepared when required.

Into what three classes are suppository moulds divided?* Into: 1. Individual moulds. 2. Divided moulds. 3. Hinged moulds.

What are Suppository Capsules? "Dr. F. E. Stewart has suggested the employment of gelatin shells, with conical caps, to be used as suppositories. The medicating ingredients are inserted in the lower portion; the upper margin is then moistened with water, and the cap inserted. Before introducing them into the rectum, they should be wet with sufficient water to enable them to slip in easily."

What are Urethral Suppositories, or Bougies? They are suppositories usually made of gelatin, in the form of bougies, and used to medicate the mucous surface of the urethra. They may be prepared by melting together 3 p. gelatin, 1 p. glycerin, 1 p. distilled water (by weight), adding the desired medicament, and moulding into cylinders in a well-oiled glass tube, afterward cutting the cylinders into the desired lengths.

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* For excellent descriptions of the various forms of suppository moulds, see Remington's "*Practice of Pharmacy*."

PART III.

THE PREPARATIONS OF THE INORGANIC MATERIA MEDICA.

HYDROGEN, OXYGEN, AND WATER.

H; 1. O; 15.96. H_2O; 17.96.

Hydrogen and oxygen are colorless, odorless gases, of no special interest pharmaceutically, except that they combine to form water, which is of the greatest importance in pharmacy. Hydrogen is also unity for quantivalence and atomic weight.

H is combustible; O aids combustion.

AQUA, U. S.—Water.—A colorless, limpid liquid, without odor and taste at ordinary temperatures, and remaining odorless while being heated to boiling; of a perfectly neutral reaction.

AQUA DESTILLATA, U. S.—Distilled Water.—A colorless, limpid liquid, without odor or taste, and of a neutral reaction. On evaporating 1000 C.c. no residue should remain.

In pharmacy, water is used principally as a solvent.

AQUA HYDROGENII DIOXIDI, U. S.—Solution of Hydrogen Dioxide, or Peroxide.—An odorless, slightly acid, aqueous solution of Hydrogen Dioxide (H_2O_2; 33.92) containing, when freshly prepared, about 3 per cent. by weight of the pure Dioxide, corresponding to about 10 vol. of available Oxygen, sp. gr. about 1.006 to 1.012 at 15° C. (59° F.). Made by decomposing barium peroxide with phosphoric acid, $BaO_2 + 2H_3PO_4 = Ba(H_2PO_4)_2 + H_2O_2$. Remove traces of the barium salt in the sol. by the cautious addition of H_2SO_4.

Antiseptic and disinfectant. Keep in cool place.

THE INORGANIC ACIDS.

Acids are distinguished from other bodies by THREE PROPERTIES. 1. They all contain hydrogen, and are sometimes called hydrogen salts. The hydrogen is capable of being replaced by metals to form salts. 2. Those which are soluble in water have a characteristic, sour taste, and corrosive action. 3. They act on litmus and other vegetable substances, changing their color.

The inorganic acids will be considered in the following order:—1st. *Hydracids*, or those not containing O, derived from non-metallic elements. Ex., HCl, HBr. 2d. The O acids from non-metallic elements. Ex., HNO_3, H_2SO_4, H_2SO_3, etc. *Anhydrides:* A class of *acid-forming oxides*, erroneously termed acids—such as Arsenous Acid, Chromic Acid, Carbonic Acid (CO_2), etc.

The suffixes "ous" and "ic," are used as terminations to the names of acids containing O; the former denoting a lower proportion of O, the lattter a higher amount. Ex., Sulphur*ous* acid, H_2SO_3, contains less O than sulphur*ic* acid, H_2SO_4.

Many of the official inorganic acids are solutions of gases in water, the amount of gas in solution varying in the stronger acids; but the official class known as *diluted* acids are intended to be uniform.

Medical Properties.—Tonic and refrigerant in the dilute form; caustic and corrosive poisons when strong.

Antidotes.—Large amounts of *mild* alkalies administered with some bland, fixed oil. (Soap, carbonate or bicarbonate of sodium, dissolved in water; after which, draughts of oil.)

ACIDUM HYDROCHLORICUM, U. S.—Hydrochloric Acid. *Muriatic Acid.* HCl.—A colorless, fuming liquid, composed of 31.9 per cent. absolute HCl and 68.1 per cent. water, with a sp. gr. 1.163; pungent, suffocating odor; intensely acid taste; strongly acid reaction.

Preparation.—Principally as a by-product in the manufacture of soda-ash, by decomposing NaCl at a high temperature with H_2SO_4. The process has two steps:—

1st Step.—Decomposition of half of the NaCl.

$$\underset{\substack{\text{Sodium}\\\text{Chloride.}}}{2NaCl} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{H_2SO_4} = \underset{\substack{\text{Hydrochlo-}\\\text{ric Acid.}}}{HCl} + \underset{\substack{\text{Sodium}\\\text{Chloride.}}}{NaCl} + \underset{\substack{\text{Acid Sodium}\\\text{Sulphate.}}}{NaHSO_4}.$$

2d Step.—Decomposition remaining NaCl at 220° C. (428° F.), or over.

$$\underset{\substack{\text{Sodium}\\\text{Chloride.}}}{NaCl} + \underset{\substack{\text{Acid Sodium}\\\text{Sulphate.}}}{NaHSO_4} = \underset{\substack{\text{Hydrochlo-}\\\text{ric Acid.}}}{HCl} + \underset{\substack{\text{Sodium}\\\text{Sulphate.}}}{Na_2SO_4}$$

The yellow color in common hydrochloric acid is due to organic substances, a trace of iron, nitrogen peroxide, or free chlorine.

ACIDUM HYDROCHLORICUM DILUTUM, U. S.—Diluted Hydrochloric Acid.—A colorless liquid, containing 10 per cent. of absolute HCl, and prepared by diluting 100 Gm. Hydrochloric Acid with 219 Gm. Distilled Water. Sp. gr. 1.050; odorless; strongly acid taste; acid reaction.

ACIDUM HYDROBROMICUM DILUTUM, U. S.—Diluted Hydrobromic Acid. HBr.—A clear, colorless liquid, composed of 10 per cent. absolute HBr and 90 per cent. water. Sp. gr. 1.077; odorless; strongly acid taste; acid reaction.

Preparation.—Two methods—1st, distillation; 2d, double decomposition and precipitation.

1st Method (distillation).—Decompose potassium bromide with sulphuric acid. This forms acid potassium sulphate (crystals) and hydrobromic acid (liquid). Separate the liquid HBr from the crystals and distill it in a retort nearly to dryness, then add q. s. distilled water to make the product contain 10 per cent. actual HBr.

$$\underset{\substack{\text{Potassium}\\\text{Bromide.}}}{KBr} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{H_2SO_4} = \underset{\substack{\text{Acid Potassium}\\\text{Sulphate.}}}{KHSO_4} + \underset{\substack{\text{Hydrobromic}\\\text{Acid.}}}{HBr.}$$

2d Method (precipitation).—Add tartaric acid to a solution of potassium bromide (400 gr. acid to 340 gr. bromide in 4 fl. oz. water). Tartrate of potassium precipitates and HBr remains in solution.

ACIDUM HYPOPHOSPHOROSUM DILUTUM, U. S.—Diluted Hypophosphorous Acid.—A liquid composed of about 10 per cent. by weight of absolute Hypophosphorous Acid ($HPH_2O_2 = 65.88$), and about 90 per cent. of water. A colorless liquid, without odor, and having an acid taste. Sp. gr. about 1.046 at 15° C. (59° F.). Miscible, in all proportions, with water.

ACIDUM NITRICUM, U. S.—Nitric Acid. HNO_3. *Aqua Fortis.*—A colorless, fuming, very caustic and corrosive liquid, composed of 68 per cent., by weight, absolute HNO_3, and 32 per cent. water ($HNO_3 = 62.89$); sp. gr. 1.414; peculiar, somewhat suffocating odor; strongly acid reaction.

Preparation.—By acting on Chili Saltpetre (sodium nitrate) with H_2SO_4. If two molecules of $NaNO_3$ and one of H_2SO_4 be taken, the reaction will be as follows:—

Decomposition of 1st molecule $NaNO_3$.

$$\underset{\text{Sodium Nitrate.}}{NaNO_3} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Acid Sodium Sulphate.}}{NaHSO_4} + \underset{\text{Nitric Acid.}}{HNO_3}.$$

Then by raising the heat, the $NaHSO_4$, acts upon the second molecule of $NaNO_3$.

Decomposition of 2d molecule $NaNO_3$.

$$\underset{\text{Sodium Nitrate.}}{NaNO_3} + \underset{\text{Acid Sodium Sulphate.}}{NaHSO_4} = \underset{\text{Sodium Sulphate.}}{Na_2SO_4} + \underset{\text{Nitric Acid.}}{HNO_3}.$$

There are several varieties of nitric acid in commerce. The official acid of 1.414 sp. gr. is termed 43° acid. The ordinary weaker commercial acid of 1.355 sp. gr. is called 38° acid. The reddish acid, known as *nitrous* acid, is nitric acid containing more or less nitrogen tetroxide (N_2O_4). The same acid may be made by impregnating nitric acid with nitrogen dioxide (N_2O_2).

The effect of red heat on nitric acid.—It evolves O, as follows:—

$$4HNO_3 + \text{Heat} = (N_2O_4)_2 + O_2 + (H_2O)_2.$$

The Great Characteristic Property of Nitric Acid.—It oxidizes sulphur and phosphorus, giving rise to sulphuric and phosphoric acids, and it oxidizes all the metals with but few exceptions. It is the great oxidizing agent.

ACIDUM NITRICUM DILUTUM, U. S.—Dilute Nitric Acid.—A colorless liquid, containing 10 per cent. absolute HNO_3 (14.3 per cent. official nitric acid). Sp. gr. 1.057. Prepared by diluting 100 gm. Nitric Acid with 580 gm. Distilled Water.

ACIDUM NITROHYDROCHLORICUM, U. S.—Nitrohydrochloric Acid. *Nitromuriatic Acid. Aqua Regia.*—A golden-yellow, fuming, and very corrosive liquid, having a strong odor of Cl, and a strong acid reaction, and containing nitrosyl chloride and free chlorine. *It is made by mixing* together 180 C.c. nitric acid, 820 C.c. hydrochloric acid in a capacious open glass vessel, and, after effervescence ceases, preserving in a cool, dark place, in glass-stoppered bottles, half full.

$$\underset{\text{Nitric Acid.}}{HNO_3} + \underset{\text{Hydrochloric Acid.}}{3HCl} = \underset{\text{Nitrosyl Chloride.}}{NOCl} + \underset{\text{Chlorine.}}{Cl_2} + \underset{\text{Water.}}{2H_2O}$$

Nitrohydrochloric acid should be kept in a cool, dark place, because it loses Cl by heat, and its Cl is converted into HCl by the action of light and the decomposition of its water.

It is called *Aqua Regia*, because of its power of dissolving gold, the king of metals.

It is indispensable, in keeping and dispensing it, that care should be taken not to confine it until all effervescence ceases, or explosion is likely to occur. And the same care should be exercised in dispensing it in mixtures.

ACIDUM NITROHYDROCHLORICUM DILUTUM, U. S.—Diluted Nitrohydrochloric Acid.—A colorless, or pale yellow liquid, odorless, or with faint odor of Cl, with a very acid taste and reaction, made by mixing 40 C.c. nitric acid with 180 C.c. hydrochloric acid, and after effervescence has entirely ceased, diluting with 780 C.c. distilled water to make 1000 C.c.

These directions should be literally obeyed, because, unless the acids are mixed while concentrated, NOCl and Cl are not produced.

ACIDUM SULPHURICUM, U. S.—Sulphuric Acid. H_2SO_4. *Oil of Vitriol.*—A colorless liquid, of an oily appearance, composed of not less than 92.5 per cent. absolute H_2SO_4 and not more than 7.5 per cent. water, and with sp. gr. not below 1.835; inodorous; strongly caustic and corrosive; strongly acid reaction.

Sulphuric Acid is prepared by burning S or FeS_2 (iron pyrites) in the air, by which SO_2 is formed. These fumes are conducted into leaden chambers and allowed to mix with steam and nitrous fumes obtained from the decomposition of sodium nitrate. The SO_2 is oxidized into SO_3 by the nitrous fumes containing nitrogen tetroxide (N_2O_4), which gives up part of its O for that purpose. SO_3 then unites with the H_2O (steam) present to form H_2SO_4. The H_2SO_4 condenses on the floor of the leaden chambers and is afterward drawn off and concentrated.

The reactions are as follows: First two molecules of SO_2 react with one molecule of N_2O_4, thus:—

$$\underset{\text{Sulphurous Oxide.}}{2SO_2} + \underset{\text{Nitrogen Tetroxide.}}{N_2O_4} = \underset{\text{Sulphuric Oxide.}}{2SO_3} + \underset{\text{Nitrogen Dioxide.}}{N_2O_2}.$$

In this reaction, N_2O_4 gives up two atoms of its O to $2SO_2$, which becomes $2SO_3$ in consequence, and N_2O_4 is reduced to N_2O_2. Then N_2O_2 goes back to the air for more O, and becomes N_2O_4 again ($N_2O_2 + O_2 = N_2O_4$). The N_2O_4 thus formed gives up its O_2 to fresh portions of $2SO_2$, converting it into $2SO_3$, as before, and this operation is repeated again and again, until all the $2SO_2$ is oxidized into $2SO_3$. During this time the $2SO_3$ that is formed unites with the vapors of H_2O present, and forms H_2SO_4 ($SO_3 + H_2O = H_2SO_4$). The nitrous fumes thus act as an oxygen carrier between sulphur*ous* oxide and the air, and raise the former to sulphur*ic* oxide.

ACIDUM SULPHURICUM AROMATICUM, U. S.—Elixir of Vitriol.—An aromatic elixir of sulphuric acid, prepared by mixing together Sulphuric Acid 100 C.c.; Tr. Ging. 50 C.c.; Ol. Cinnam. 1 C.c.; Alcohol to 1000 C.c.

ACIDUM SULPHURICUM DILUTUM, U. S.—Diluted Sulphuric Acid.—A colorless liquid, containing 10 per cent., by weight, official sulphuric acid, with sp. gr. 1.070, and prepared by diluting 100 Gm. Sulphuric Acid with 825 Gm. Distilled Water to make 925 Gm.

ACIDUM SULPHUROSUM, U. S.—Sulphurous Acid. H_2SO_3.—A colorless liquid, of a characteristic sulphurous odor and taste, with sp. gr. 1.035, composed of about 6.4 per cent., by weight, of sulphurous anhydride and not more than 93.6 per cent. of water. It has a characteristic odor of burning sulphur; very acid, sulphurous taste; strongly acid reaction.

Preparation.—By pouring 80 C.c. H_2SO_4 on 20 Gm. coarsely powdered charcoal, in a flask connected with a wash-bottle, and a bottle partially filled with 1000 C.c. distilled water. Gentle heat is applied, and the gas distilled over. A bottle containing a solution of Na_2CO_3 is provided to absorb the excess of gas that bubbles up through the distilled water, and the latter is kept cool by placing ice around the bottle, as cold water will absorb more gas than warm water.

Equation for the reaction that occurs :—

$$\underset{\text{Sulphuric Acid.}}{4H_2SO_4} + \underset{\text{Charcoal.}}{C_2} = \underset{\text{Sulphurous Acid Gas.}}{4SO_2} + \underset{\text{Carbon Dioxide.}}{2CO_2} + \underset{\text{Water.}}{4H_2O.}$$

ACIDUM PHOSPHORICUM, U. S.—Phosphoric Acid. *Syrupy Phosphoric Acid.*—A colorless, syrupy liquid, of sp. gr. 1.710, composed of not less than 85 per cent., by weight, of absolute orthophosphoric acid ($H_3PO_4 = 97.8$) and not more than 15 per cent. of water. Odorless; strongly acid taste; acid reaction.

Pour 12 fl. oz., dist. water mixed with 11 fl. oz. HNO_3 into a 2-pint flask. Add 40 grains bromine and shake gently until dissolved. Now add 2 oz. P. and set aside so that nitrous vapors may be carried off without injury.

ACIDUM PHOSPHORICUM DILUTUM, U. S.—Diluted Phosphoric Acid.—A colorless liquid of sp. gr. 1.057, containing 10 per cent. absolute orthophosphoric acid, by weight, and prepared by diluting 100 Gm. of phosphoric acid with 750 Gm. distilled water to make 850 Gm.

A precipitate sometimes occurs on mixing this acid with tincture of chloride of iron, generally due to the presence of pyrophosphoric acid. Pyrophosphate of iron is formed as an insoluble gelatinous precipitate.

CHLORINE, BROMINE, AND IODINE.

(THE HALOGENS.)

Cl; 35.37. Br; 79.76. I; 126.53.

The four Halogens (salt producers) are *Chlorine*, *Bromine*, *Iodine*, *Fluorine.* The latter is not used in Pharmacy.

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CHLORINE—CHLORINE. Cl; 35.37.

A greenish-yellow, gaseous body, having a very suffocating odor, and sp. gr. 2.45 (when liquefied, 1.33).

AQUA CHLORI, U. S.—Chlorine Water.—A greenish-yellow, clear liquid, having the suffocating odor and disagreeable taste of chlorine, made by passing Cl gas, generated by heating HCl with manganese dioxide, into distilled water until a saturated solution is produced. Should contain 0.4 per cent. of the gas.

Equation for the reaction that occurs :—

$$\underset{\text{Manganese Dioxide.}}{MnO_2} + \underset{\text{Hydrochloric Acid.}}{4HCl} = \underset{\text{Manganese Chloride.}}{MnCl_2} + \underset{\text{Chlorine.}}{Cl_2} + \underset{\text{Water.}}{2H_2O.}$$

Chlorine Water should be secluded from the light, because it is partially converted into HCl by the light, owing to the decomposition of the water, the Cl uniting with the H of the water to form HCl.

Chlorine Water may be made extemporaneously by placing HCl f℥iv in a pint bottle, adding Potass. Chlor., 40 gr. When the bottle is full of Cl vapor, add 1 fluidounce Distilled Water. Not recommended.

CALX CHLORATA, U. S.—Chlorinated Lime.—A white, or grayish-white, granular powder, or friable lumps, becoming moist and gradually decomposing on exposure to air, having a hypochlorous acid odor, and a disagreeable, saline taste, containing not less than 35 per cent. available chlorine, and prepared by subjecting calcium hydrate, placed on trays in a suitable chamber, to the action of chlorine.

Its chemical formula is probably $CaOCl_2$, yielding, by decomposition with water, calcium hypochlorite and calcium chloride. It is used as a disinfectant and for bleaching purposes, and its usefulness depends on its chlorine, which being loosely combined, is, therefore, available.

LIQUOR SODÆ CHLORATÆ, U. S.—Solution of Chlorinated Soda. *Labarraque's Solution.*—A clear, pale greenish liquid, of a faint odor of chlorine, a disagreeable and alkaline taste, and an alkaline reaction, made by decomposing solution of chlorinated lime with sodium carbonate, and containing sodium hypochlorite and sodium chloride, calcium carbonate separating out as a precipitate.

Equation expressing the reaction :—

$$\underset{\text{Chlorinated Lime.}}{Ca(OCl)_2 + CaCl_2} + \underset{\text{Sodium Carbonate.}}{2Na_2CO_3} = \underset{\text{Sodium Hypochlorite.}}{2NaOCl} + \underset{\text{Sodium Chloride.}}{2NaCl} + \underset{\text{Calcium Carbonate.}}{2CaCO_3.}$$

Eau de Javelle (*Javelle Water*) is a French preparation made with K_2CO_3 instead of Na_2CO_3.

BROMUM, U. S.—BROMINE. Br; 79.76.

A dark brownish-red, mobile liquid, evolving, even at the ordinary temperature, a yellowish-red vapor highly irritating to the eyes and lungs; peculiarly suffocating odor, resembling that of chlorine. Prepared by decomposing crude magnesium bromide (bittern) with chlorine gas.

$$\underset{\text{Magnesium Bromide.}}{MgBr_2} + \underset{\text{Chlorine.}}{2Cl} = \underset{\text{Magnesium Chloride.}}{MgCl_2} + \underset{\text{Bromine.}}{2Br.}$$

Bibron's Antidote to Rattlesnake Poison.—Bromine, 300 gr.; Dil. Alcohol, f℥ viij. Mix. KI, 4 gr.; Corros. Sub. 2 gr. Place in a mortar and add q. s. of the solution to dissolve them.

IODUM, U. S.—IODINE. I; 126.53.

Heavy, bluish-black, dry and friable, rhombic plates, of a metallic lustre, distinctive odor, sharp and acrid taste, neutral reaction, formerly obtained exclusively from the ashes of seaweed (kelp), but now made from the mother-liquor obtained from the crystallization of sodium nitrate in South America, in which it occurs in the forms of sodium iodide and iodate.

Preparation.—The iodides are decomposed by Cl, iodine being set free, whilst the iodine from the iodates is precipitated by acid sodium sulphite. *Kelp* contains iodine in the form of NaI. The solution from it is treated with H_2SO_4 and distilled with MnO_2. The I condenses in glass receivers.

$$\underset{\text{Sodium Iodide.}}{2NaI} + \underset{\text{Sulphuric Acid.}}{2H_2SO_4} + \underset{\text{Manganese Dioxide.}}{MnO_2} = \underset{\text{Iodine.}}{I_2} + \underset{\text{Manganese Sulphate.}}{MnSO_4} + \underset{\text{Sodium Sulphate.}}{Na_2SO_4} + \underset{\text{Water.}}{2H_2O}.$$

The U. S. P. preparations of Iodine: *Tinctura Iodi, Liquor Iodi Compositus, Unguentum Iodi.*

SYRUPUS ACIDI HYDRIODICI, U. S.—Syrup of Hydriodic Acid.—A syrupy liquid, containing 1 per cent. of absolute Hydriodic Acid, having the sp. gr. 1.313, and is made by dissolving KI and potassium hypophosphite in water, and decomposing them by adding a solution of tartaric acid in diluted alcohol.

SULPHUR AND PHOSPHORUS.

S; 31.98. P; 30.96.

SULPHUR. S; 31.98.

Sulphur occurs uncombined in Sicily and in other parts of the world, and is widely diffused in the form of sulphates and sulphides.

Roll sulphur is prepared by fusing sulphur, permitting it to stand, to separate impurities, and then pouring into cylindrical moulds.

Three forms of sulphur are official: *sublimed, washed,* and *precipitated* sulphur.

HYDROSULPHURIC ACID.—Sulphuretted Hydrogen.—An offensive gas formed by the combination of two parts hydrogen with one part sulphur, H_2S, also known as *hydrogen sulphide.* It is made by acting on ferrous sulphide with dilute sulphuric acid, and is used for testing the presence of metals, with which it forms characteristic precipitates.

SULPHUR SUBLIMATUM, U. S.—Flowers of Sulphur.—A fine, citron-yellow powder, of a slight characteristic odor, and generally of a faintly-acid taste, made by conducting the vapor of sulphur into a cool chamber, where it condenses in the form of crystalline powder. U. S. Preparations: *Sulphur Lotum, Sulphur Præcipitatum.*

SULPHUR LOTUM, U. S.—Washed Sulphur.—A fine, citron-*yellow powder,* odorless and almost tasteless, made by washing sublimed sulphur with water containing ammonia, to rid it of sulphuric acid and other impurities. U. S. Preparations: *Pulvis Glycyrrhizæ Compositus*, *Unguentum Sulphuris.*

SULPHUR PRÆCIPITATUM, U. S.—Precipitated Sulphur.—A very fine, yellowish-white, amorphous powder, odorless and almost tasteless, made by precipitating a solution of calcium disulphide with hydrochloric acid.

Calcium disulphide is prepared by boiling unslaked lime with sublimed sulphur, cooling, and filtering off the clear solution of calcium disulphide, which is then precipitated with HCl.

Equations describing the reactions that occur:—

1st. The lime and sulphur react to form calcium disulphide and calcium thiosulphate (hyposulphite).

$$\underset{\substack{\text{Calcium}\\\text{Oxide.}}}{3CaO} + \underset{\text{Sulphur.}}{6S} = \underset{\substack{\text{Calcium}\\\text{Disulphide.}}}{2CaS_2} + \underset{\substack{\text{Calcium}\\\text{Thiosulphate.}}}{CaS_2O_3}.$$

2d. HCl is added, which precipitates the sulphur.

$$\underset{\substack{\text{Calcium}\\\text{Disulphide.}}}{2CaS_2} + \underset{\substack{\text{Calcium}\\\text{Thiosulphate.}}}{CaS_2O_3} + \underset{\substack{\text{Hydrochloric}\\\text{Acid.}}}{6HCl} = \underset{\substack{\text{Calcium}\\\text{Chloride.}}}{3CaCl_2} + \underset{\text{Sulphur.}}{6S} + \underset{\text{Water.}}{3H_2O}.$$

Lac Sulphuris, or Milk of Sulphur.—In some processes, H_2SO_4 is used instead of HCl. This precipitates calcium sulphate with the sulphur, giving it a milky color. It is an inferior product.

SULPHURIS IODIDUM, U. S.—Sulphur Iodide.—A grayish-black solid, generally in pieces, having a radiated, crystalline appearance, with a characteristic odor of iodine; somewhat acrid taste; faintly acid reaction; made by heating 20 Gm. sulphur with 80 Gm. iodine. It is also known as *subiodide* of *sulphur*, or *iodine disulphide* (?), S_2I_2.

CARBONEI BISULPHIDUM, U. S.—Disulphide of Carbon.—A clear, colorless, very diffusive, highly refractive liquid, with strong characteristic odor, and sharp, aromatic taste; neutral. Sp. gr. 1.268 to 1.269. Made by the direct combination of carbon and sulphur, at a moderate red heat.

Preparation.—Charcoal is heated to redness, in a vertical cylinder provided with a lateral tubulure near the bottom, through which sulphur is admitted. The sulphur melts, volatilizes, and unites with the carbon, forming carbon bisulphide. This distills over and condenses in tubes, which collect it while allowing the H_2S formed at the same time to escape. It is then purified by agitation with mercury, and distillation in contact with white wax. By repeated rectification it can be made odorless. Used principally as a solvent. Best solvent for rubber, etc.

PHOSPHORUS. P; 30.96.

A translucent, nearly colorless solid, of a waxy lustre, having, at the ordinary temperature, about the consistence of beeswax, and with a distinctive, disagreeable odor and taste. It is prepared by deoxidizing phosphoric acid with carbon. This is accomplished by heating acid calcium phosphate, obtained by treating calcium phosphate with sulphuric acid, with charcoal.

$$\begin{array}{ccccccc} Ca_3(PO_4)_2 & + & 2H_2SO_4 & = & CaH_4(PO_4)_2 & + & 2CaSO_4. \\ \text{Calcium} & & \text{Sulphuric} & & \text{Acid Calcium} & & \text{Calcium} \\ \text{Phosphate.} & & \text{Acid.} & & \text{Phosphate.} & & \text{Sulphate.} \end{array}$$

The process is conducted in a retort. Carbon, at a high temperature, takes oxygen from the phosphoric acid, and becomes carbonic acid. Phosphorus and carbonic oxide distill over, and the former is condensed in water, while the latter escapes.

Red Phosphorus.—A non-luminous, non-poisonous, red amorphous powder, consisting of phosphorus in one of its allotropic forms, prepared by allowing phosphorus to remain in an atmosphere of carbon dioxide for several days, at a temperature ranging from 215° to 250° C. (419°–482° F.). By heating it to 280° C. (536° F.) it is converted into ordinary phosphorus.

The three oxides formed by phosphorus are: Phosphoric Oxide, $P_2^{v}O_5^{II}$; Phosphorous Oxide, $P_2^{III}O_3^{II}$; and Hypophosphorous Oxide (?), $P_2^{I}O^{II}$.

The three corresponding acids are: Orthophosphoric Acid (tribasic acid), H_3PO_4; Pyrophosphoric Acid, $H_4P_2O_7$; and Metaphosphoric Acid, HPO_3.

These acids are prepared as follows; Orthophosphoric Acid—by dissolving P_2O_5 in boiling water ($P_2O_5 + 3H_2O = 2H_3PO_4$). Pyrophosphoric Acid—by heating orthophosphoric acid to 213° C. (415° F.). Metaphosphoric Acid—by igniting orthophosphoric acid.

Orthophosphoric acid may also be made by acting on P with HNO_3. Metaphosophoric acid may also be prepared by dissolving P_2O_5 in cold water.

The official Acidum Phosphoricum is the orthophosphoric acid.

There are two other phosphoric acids; Phosphorous Acid H_3PO_3 (dibasic, containing one H atom not replaceable by a metal); and Hypophosphorous Acid, H_3PO_2 (monobasic, containing two H atoms not replaceable by a metal). These acids cannot be produced directly from their corresponding oxides, Phosphorous Oxide (P_2O_3), and Hypophosphorous Oxide, P_2O.

Official preparations of Phosphorus: *Oleum Phosphoratum*, *Pilulæ Phosphori, and Spiritus Phosphori.*

CARBON, BORON, AND SILICON.

C; 11.97. B; 10.9. Si; 28.3.

CARBON. C; 11.97.

Carbon is a constituent of all organic substances, and found in nature in the forms of coal, plumbago, diamond, etc.

The two oxides of carbon and their corresponding acids are, carbon dioxide, CO_2, and carbonic acid, H_2CO_3 ($CO_2 + H_2O = H_2CO_3$), carbon monoxide, CO, which is of little interest in pharmacy.

Carbon Dioxide.—A colorless, odorless gas, with slightly acid taste, heavier than the air, incombustible and a non-supporter of combustion. Water absorbs its own volume of it at ordinary temperature and pressure, and many times its volume under cold and pressure.

Aqua Acidi Carbonici or "Soda Water." A solution of Carbon dioxide in water made under pressure, and dispensed under the well-known name, "Soda Water." It was formerly official.

CARBO ANIMALIS, U. S.—Animal Charcoal. *Bone Black, or Ivory Black.*—Dull black, granular fragments, or a dull-black powder, odorless and nearly tasteless, prepared by subjecting bones to a red heat in close vessels.

Preparation.—Bones consist of calcium phosphate and carbonate with animal matter. In the destructive distillation, which is conducted in iron cylinders without access of air, the N and H of the animal matter unite to form NH_3, which distills over, leaving most of the C behind with the calcium salts.

Bone Spirit and Bone Oil.—The ammoniacal liquor and dark tarry liquid that distill over are known as bone spirit and bone oil, respectively.

CARBO ANIMALIS PURIFICATUS, U. S.—Purified Animal Charcoal.—Animal charcoal purified from calcium salts by HCl.

CARBO LIGNI, U. S.—Charcoal.—Prepared by burning wood out of contact with the air, whereby its volatile portions, hydrogen, oxygen, water, etc., are dissipated, carbon, mixed with mineral salts, being left.

BORON. B; 10.9.

Boron exists in three allotropic forms, amorphous, crystalline, and graphitoidal (same as carbon).

The result of its combination with O and H is Boric (Boracic) Acid, H_3BO_3.

ACIDUM BORICUM, U. S.—Boric Acid. *Boracic Acid.* $H_3BO_3 = 61.78$.—Is obtained in the lagoons in Tuscany; in California lakes, etc., in the forms of boric acid and borate of sodium (borax). Boric acid is made by decomposing borax with HCl:—

$$\underset{\text{Sodium Borate.}}{Na_2B_4O_7 10H_2O} + \underset{\text{Hydrochloric Acid.}}{2HCl} = \underset{\text{Sodium Chloride.}}{2NaCl} + \underset{\text{Boric Acid.}}{4H_3BO_3} + \underset{\text{Water.}}{5H_2O.}$$

Acidum Boricum occurs in the form of transparent, colorless, six-sided plates, slightly unctuous to the touch, permanent in the air. Odorless; cooling, bitterish taste, feebly acid in solution.

SILICON. Si; 28.3.

Silicon exists in three allotropic forms, amorphous, crystalline, and graphitoidal.

It is found in combination with Al, Mg, and Ca, in pumice, meerschaum, asbestos, etc., and as an anhydride (silica) in sand, flint, quartz, etc.

SILICA. SiO_2.—**Silicic Anhydride.**—Is obtained in a pure condition by treating the official solution of silicate of sodium with HCl:—

$$\underset{\text{Sodium Silicate.}}{Na_2SiO_3} + \underset{\text{Hydrochloric Acid.}}{2HCl} = \underset{\text{Silica.}}{SiO_2} + \underset{\text{Sodium Chloride.}}{2NaCl} + \underset{\text{Water.}}{H_2O.}$$

LIQUOR SODII SILICATIS, U. S.—(Na_2SiO_3). **Soluble Glass.**—A semi-transparent, almost colorless, or yellowish, or pale greenish-yellow, viscid liquid, sp. gr. 1.3 or 1.4. Odorless; sharp, saline, and alkaline taste; alkaline reaction. Made by fusing 1 p. fine sand (silica) with 2 p. dried sodium carbonate, and dissolving the product.

Used in surgery to prepare mechanical dressings.

POTASSIUM, SODIUM, LITHIUM, AND AMMONIUM.

K; 39.03 Na; 23 Li; 7.01 NH_4; 18.01.

Alkaline Metals and their Characteristics.—The alkaline metals are Potassium, Sodium, and Lithium. They are characterized, 1, by their silvery-white appearance; 2, softness; 3, powerful affinity for oxygen; 4, lightness, being lighter than water, on which they float and take fire spontaneously, owing to their power of decomposing that fluid. They are all univalent.

The metals may be obtained by exposing their carbonates, mixed with charcoal, to an intense heat, carbon monoxide being liberated, and the vaporized metals condensed in appropriate receivers.

Ammonium is a compound radical, consisting of NH_4, but, owing to its many analogies with the alkali metals, classed with them.

Characteristics of Alkalies.—1. They combine with acids to form salts. 2. They restore the color of reddened litmus, turn vegetable blues to green, and yellow to brown. 3. Their taste is characteristic and, if concentrated, caustic.

POTASSIUM.

Sources of Potassium Salts.—Formerly, wood ashes; now, the principal source is an impure chloride from the Stassfurt mines, in Germany.

Lye, Potash, and *Pearlash.*—When wood is burned to ashes, the salts of potassium contained therein are converted into *carbonates.* Wood ashes are placed in a conical wooden vessel, termed a *leach,* and water allowed to percolate through, which becomes impregnated with the potassium carbonate contained in the ashes, and the solution is called *lye.* By evaporating lye to dryness in an iron pot, a solid remains, consisting principally of impure carbonate, which is called *potash.* Potash, calcined on the hearth of a reverberatory furnace, loses its water and becomes white. It is then known as *pearlash,* and is an impure carbonate of potassium.

POTASSA, U. S.—Potassa. *Potassium Hydrate, Potassium Hydroxide, Caustic Potash.* KHO; 55.99.—A white, hard, and dry solid, generally in form of pencils; very deliquescent; odorless or having a faint odor of lye; very acrid and caustic taste; strongly alkaline reaction. Prepared from wood ashes by lixiviating, evaporating, purifying, redissolving, treating with lime, evaporating, fusing, and casting into moulds.

$$\underset{\substack{\text{Potassium}\\ \textit{Carbonate.}}}{K_2CO_3} + \underset{\substack{\text{Calcium}\\ \text{Hydrate.}}}{Ca(OH)_2} = \underset{\substack{\text{Potassium}\\ \text{Hydrate.}}}{2KHO} + \underset{\substack{\text{Calcium}\\ \text{Carbonate.}}}{CaCO_3}.$$

POTASSA CUM CALCE, U. S.—Potassa with Lime.—A grayish-white powder, deliquescent, strongly alkaline, made by mixing together equal parts well-dried potassa and lime.

LIQUOR POTASSÆ, U. S.— Solution of Potassa.—An aqueous solution of hydrate of potassium, containing about 5 per cent. of the hydrate; clear and colorless; odorless; with very acrid and caustic taste; strongly alkaline reaction. Made by decomposing potassium bicarbonate through the action of calcium hydrate and heat, or by dissolving the hydrate in water.

POTASSA SULPHURATA, U. S.—Sulphurated Potassa. *Liver of Sulphur.*—An indefinite chemical compound, occurring in irregular pieces, of a liver-brown color when freshly prepared, turning gradually to greenish-yellow or brownish-yellow, with a faint, disagreeable odor, and bitter, alkaline, repulsive taste; alkaline reaction. Made by melting potassa and sulphur together in a crucible, pouring the liquid on a slab, and cooling.

$$3K_2CO_3 + 4S_2 = 2K_2S_3 + K_2S_2O_3 + 3CO_2.$$

POTASSII ACETAS, U. S.—Potassium Acetate. $KC_2H_3O_2$; 97.89.—White, foliaceous, satiny, crystalline masses, or a white, granular powder; very deliquescent; odorless; warming, mildly pungent, and saline taste; neutral or faintly alkaline reaction. Made by decomposing potassium bicarbonate with acetic acid, filtering and evaporating, carefully avoiding contact with iron.

$$\underset{\substack{\text{Potassium}\\\text{Bicarbonate.}}}{KHCO_3} + \underset{\text{Acetic Acid.}}{HC_2H_3O_2} = \underset{\substack{\text{Potassium}\\\text{Acetate.}}}{KC_2H_3O_2} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{CO_2} + \underset{\text{Water.}}{H_2O.}$$

POTASSII BICARBONAS, U. S.—Potassium Bicarbonate. $KHCO_3$; 99.88.—Colorless, transparent, monoclinic prisms, permanent in dry air; odorless; saline and slightly alkaline taste; feebly alkaline reaction. Made by passing carbon dioxide into a solution of carbonate, evaporating, and crystallizing.

$$\underset{\substack{\text{Potassium}\\\text{Carbonate.}}}{K_2CO_3} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{CO_2} + \underset{\text{Water.}}{H_2O} = \underset{\substack{\text{Potassium}\\\text{Bicarbonate.}}}{2KHCO_3.}$$

POTASSII BICHROMAS, U. S.—Potassium Bichromate. $K_2Cr_2O_7$; 293.78.—Large, orange-red, transparent, four-sided tabular prisms; permanent in the air; odorless; bitter, disagreeable, metallic taste; acid reaction; made by treating potassium chromate, prepared from *chrome iron ore*, with sulphuric acid, evaporating, and crystallizing

The ore is heated with potassium carbonate and chalk in contact with air, and the following reaction takes place:—

$$\underset{\text{Chrome Iron Ore.}}{2(FeOCr_2O_3)} + \underset{\substack{\text{Potassium}\\\text{Carbonate.}}}{4K_2CO_3} + \underset{\text{Oxygen.}}{7O} =$$

$$\underset{\substack{\text{Potassium}\\\text{Chromate.}}}{4(K_2CrO_4)} + \underset{\substack{\text{Ferric}\\\text{Oxide.}}}{Fe_2O_3} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{4CO_2;}$$

Then—

$$2(K_2CrO_4) + H_2SO_4 = K_2Cr_2O_7 + K_2SO_4 + H_2O.$$

POTASSII BITARTRAS, U. S.—Potassium Bitartrate. $KHC_4H_4O_6$; 187.67. *Cream of Tartar.*—Colorless, or slightly opaque, rhombic crystals, or a white, somewhat gritty powder; permanent in the air; odorless; pleasant, acidulous taste; acid reaction. Made by purifying *argol*, the sediment deposited in wine casks during fermentation.

POTASSII BROMIDUM, U. S.—Potassium Bromide. KBr; 118.79.—Colorless, translucent, cubical crystals; permanent in dry air; generally appearing in commerce in white, opaque, or semi-transparent crystals, having a faint alkaline reaction; odorless, pungent, saline taste; neutral reaction. Made by treating solution of potassa with bromine and charcoal.

The rationale of the process is as follows: Bromine added to solution potassa forms *bromide* and *bromate*. The solution is evaporated to dryness, and heated with charcoal, which deoxidizes the bromate, CO escaping.

$$\underset{\substack{\text{Potassium}\\\text{Bromate.}}}{2KBrO_3} + \underset{\text{Carbon.}}{3C_2} = \underset{\substack{\text{Potassium}\\\text{Bromide.}}}{2KBr} + \underset{\substack{\text{Carbon}\\\text{Monoxide.}}}{6CO}$$

POTASSII CARBONAS, U. S.—Potassium Carbonate. K_2CO_3; 137.91. *Sal Tartar.*—A white, crystalline or granular powder, very deliquescent at 13° C. (55.4° F.); odorless; strongly alkaline taste; alkaline reaction. Made by purifying pearlash, by dissolving it in *cold* water, filtering, evaporating, and granulating.

POTASSII CHLORAS, U. S.—Potassium Chlorate. $KClO_3$; 122.28.—Colorless, monoclinic prisms or plates, or a white powder of a pearly lustre, permanent in the air; odorless; cooling, saline taste, neutral reaction. Made by reacting on potassium chloride with calcium hypochlorite.

The rationale of the process is as follows: When solution of calcium hypochlorite is boiled, it is decomposed into calcium chlorate and chloride; and when calcium chlorate is heated with potassium chloride, double decomposition forms potassium chlorate and calcium chloride.

1st. $$\underset{\substack{\text{Calcium}\\\text{Hypochlorite.}}}{3Ca(OCl)_2} + \text{boiling} = \underset{\substack{\text{Calcium}\\\text{Chloride.}}}{2CaCl_2} + \underset{\substack{\text{Calcium}\\\text{Chlorate.}}}{Ca(O_3Cl)_2}.$$

2d. $$\underset{\substack{\text{Calcium}\\\text{Chlorate.}}}{Ca(O_3Cl)_2} + \underset{\substack{\text{Potassium}\\\text{Chloride.}}}{2KCl} = \underset{\substack{\text{Potassium}\\\text{Chlorate.}}}{2KClO_3} + \underset{\substack{\text{Calcium}\\\text{Chloride.}}}{CaCl_2}.$$

POTASSII CITRAS, U. S.—Potassium Citrate. $K_3C_6H_5O_7.H_2O$; 323.59.—A white, granular powder, deliquescent on exposure to air; odorless; slightly cooling, faintly alkaline taste; neutral or faintly alkaline reaction. Made by decomposing potassium bicarbonate with citric acid, filtering, evaporating, and granulating.

$$\underset{\substack{\text{Potassium}\\\text{Bicarbonate.}}}{3KHCO_3} + \underset{\text{Citric Acid.}}{H_3C_6H_5O_7} = \underset{\substack{\text{Potassium}\\\text{Citrate.}}}{K_3C_6H_5O_7} + \underset{\text{Water.}}{3H_2O} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{3CO_2}.$$

POTASSII CITRAS EFFERVESCENS, U. S.—Effervescent *Potassium Citrate.*—Citric Acid 63 Gm.; Potassium Bicarb. 90 Gm.; Sugar 47 Gm. Powder ingredients separately and mix in warm mortar

Dry resulting paste at temperature not exceeding 120° C. (248° F.); reduce to powder.

LIQUOR POTASSII CITRATIS, U. S.—Solution of Potassium Citrate.—An aqueous liquid containing in solution about nine per cent. of anhydrous Potassium Citrate ($K_3C_6H_5O_7$; 305.63) together with small amounts of Citric and Carbonic Acids. Used by mixing together Potass. Bicarb. 8 Gm., Citric Acid 6 Gm., Water sufficient quantity.

Neutral Mixture.—A more agreeable preparation made by merely saturating lemon juice with Potass. Bicarb. Official in U. S. P. under name Mistura Potassii Citratis.

POTASSII CYANIDUM, U. S.—Potassium Cyanide. KCN; 65.01.—White, opaque, amorphous pieces, or a white, granular powder, deliquescent in damp air; colorless when perfectly dry, but generally of a peculiar, characteristic odor; sharp, somewhat alkaline and bitter-almond taste; strongly alkaline reaction. Made by fusing potassium ferrocyanide with potassium carbonate, separating the insoluble precipitate of metallic iron, and pouring the fused mass on a slab.

$$\underset{\substack{\text{Potassium}\\ \text{Ferrocyanide.}}}{K_4Fe(CN)_6} + \underset{\substack{\text{Potassium}\\ \text{Carbonate.}}}{K_2CO_3} = \underset{\substack{\text{Potassium}\\ \text{Cyanide.}}}{5KCN} + \underset{\substack{\text{Potassium}\\ \text{Cyanate.}}}{KOCN} + \underset{\substack{\text{Carbon}\\ \text{Dioxide.}}}{CO_2} + \underset{\substack{\text{Metallic}\\ \text{Iron.}}}{Fe.}$$

POTASSII ET SODII TARTRAS, U. S.—Potassium and Sodium Tartrate. *Rochelle Salt.* $KNaC_4H_4O_6.4H_2O$; 281.51.—Colorless, transparent, rhombic crystals, slightly efflorescent in dry air, or a white powder; odorless, cooling, mildly saline, and slightly bitter taste; neutral reaction. Made by treating solution of potassium bitartrate with sodium carbonate.

$$\underset{\substack{\text{Potassium}\\ \text{Bitartrate.}}}{2KHC_4H_4O_6} + \underset{\substack{\text{Sodium}\\ \text{Carbonate.}}}{Na_2CO_3} = \underset{\substack{\text{Potassium and So-}\\ \text{dium Tartrate.}}}{2KNaC_4H_4O_6} + \underset{\text{Water.}}{H_2O} + \underset{\substack{\text{Carbon}\\ \text{Dioxide.}}}{CO_2.}$$

POTASSII FERROCYANIDUM, U. S.—Potassium Ferrocyanide. $K_4Fe(CN)_6.3H_2O$; 421.76.—Large, coherent, lemon-yellow, translucent, and rather soft, four-sided prisms or tablets, slightly efflorescent in dry air; odorless, sweetish and saline taste; neutral reaction. Made by treating nitrogenized substances (refuse animal matter) with crude pearlash, by which impure potassium cyanide is formed, lixiviating, and treating with freshly-precipitated ferrous carbonate, which produces ferrocyanide of potassium, by the following reaction:—

$$\underset{\substack{\text{Potassium}\\ \text{Cyanide.}}}{6KCN} + \underset{\substack{\text{Ferrous}\\ \text{Carbonate.}}}{FeCO_3} = \underset{\substack{\text{Potassium}\\ \text{Ferrocyanide.}}}{K_4Fe(CN)_6} + \underset{\substack{\text{Potassium}\\ \text{Carbonate.}}}{K_2CO_3.}$$

POTASSII HYPOPHOSPHIS, U. S.—Potassium Hypophosphite. KH_2PO_2; 103.91.—White, opaque, confused, crystalline masses, or a white, granular powder, very deliquescent; odorless; sharp, saline, slightly bitter taste; neutral reaction. Made by precipitating calcium hypophosphite with potassium carbonate, filtering, evaporating, and granulating, keeping it below 100° C. (212° F.) during the operation, for fear of explosion.

$$\underset{\substack{\textit{Calcium}\\ \textit{Hypophosphite.}}}{Ca2H_2PO_2} + \underset{\substack{\text{Potassium}\\ \text{Carbonate.}}}{K_2CO_3} = \underset{\substack{\text{Potassium}\\ \text{Hypophosphite.}}}{2KH_2PO_2} + \underset{\substack{\text{Calcium}\\ \text{Carbonate.}}}{CaCO_3.}$$

POTASSII IODIDUM, U. S.—Potassium Iodide. KI; 165.56. —Colorless, translucent, cubical crystals, slightly deliquescent. At a dull red heat the salt melts without losing weight. Of a peculiar faint odor, pungent, saline, afterward somewhat bitter taste; neutral reaction. Made by treating solution of potassa with iodine, evaporating to dryness and heating with charcoal. The result is, the formation of two salts, Iodide and Iodate of Potassium:—

$6KOH$	$+$	$(I_2)_3$	$=$	$5KI$	$+$	KIO_3	$+$	$3H_2O$.
Potassium Hydrate.		Iodine.		Potassium Iodide.		Potassium Iodate.		Water.

By evaporating to dryness, the mixed salts are obtained, and by exposing to heat with charcoal, the iodate is deoxidized to iodide.

POTASSII NITRAS, U. S.—Potassium Nitrate. KNO_3; 100.92.—Colorless, transparent, six-sided rhombic prisms, or a crystalline powder, permanent in the air. Odorless, cooling, saline, and pungent taste. Neutral reaction. Usually a natural product; produced artificially, however, in what are known as *nitre beds*, consisting of earth, wood-ashes, animal and vegetable refuse. Ammonia is produced by decomposition, is oxidized and nitric acid formed, which unites with the potassa in the ashes, and potassium nitrate results. This is separated by lixiviation, filtration, evaporation, and crystallization. It is commonly called Nitre or Saltpetre.

POTASSII PERMANGANAS, U. S.—Potassium Permanganate. $KMnO_4$; 157.67.—Deep, purple-violet or nearly black, needle-shaped, rhombic prisms, of a metallic lustre, permanent in the air. Odorless, sweet, afterward disagreeable, astringent taste; neutral reaction. Made by heating together manganese dioxide, potassium chlorate, and potassa.

The rationale of the reaction is as follows: The salts are mixed together and heated in a crucible, which results in a semi-fused mass; this is boiled with water and neutralized with dilute sulphuric acid, evaporated and crystallized. By this process, potassium chlorate yields oxygen to manganese dioxide, converting it into manganic acid, which unites with the potassa to form the manganate, potassium chloride being formed at the same time.

$3MnO_2$	$+$	$6KHO$	$+$	$KClO_3$	$=$	$3K_2MnO_4$	$+$	KCl	$+$	$3H_2O$.
Manganese Dioxide.		Potassium Hydrate.		Potassium Chlorate.		Potassium Manganate.		Potassium Chloride.		Water.

The potassium manganate is converted to potassium permanganate when the solution is boiled with water, as follows:—

$3K_2MnO_4$	$+$	$3H_2O$	$=$	$2KMnO_4$	$+$	$MnO_2.H_2O$	$+$	$4KHO$.
Potassium Manganate.		Water.		Potassium Permanganate.		Hydrated Manganese Peroxide.		Potassium Hydrate.

The acid is used to neutralize the potassium hydrate liberated by the reaction, for in the presence of an excess of potassa, the permanganate otherwise remains in the condition of manganate.

POTASSII SULPHAS, U. S—Potassium Sulphate. K_2SO_4; 173.88.—Colorless, hard, six-sided, rhombic prisms, permanent in the air; odorless; sharp, saline, slightly bitter taste; neutral reaction. Made by *purifying the residue from* nitric acid manufacture, also from other sources, as *Kainite*, the mineral found in the Stassfurt salt-beds, which is a double sulphate of potassium and magnesium.

It may be made directly, at any time, by decomposing potassium nitrate with sulphuric acid.

$$\underset{\substack{\text{Potassium}\\\text{Nitrate.}}}{2KNO_3} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{H_2SO_4} = \underset{\substack{\text{Potassium}\\\text{Sulphate.}}}{K_2SO_4} + \underset{\substack{\text{Nitric}\\\text{Acid.}}}{2HNO_3}.$$

SODIUM. Na; 23.

The Salts of Sodium are generally more frequently used than those of Potassium, because they are relatively cheaper and often more soluble.

SODA, U. S.—Soda. $NaHO$; 39.96.—A white, hard, opaque solid, generally in the form of fibrous pieces, or of white, cylindrical pencils, deliquescent in moist air, but in dry air becoming dry and efflorescent; odorless; intensely acrid and caustic taste; strongly alkaline reaction. Made by boiling solution of sodium carbonate with calcium hydrate and evaporating. Commercial name—Caustic Soda.

LIQUOR SODÆ, U. S.—Solution of Soda.—A clear, colorless liquid, consisting of hydrate of sodium ($NaHO$) about 5 per cent.; odorless; very acrid and caustic taste; strongly alkaline reaction. Made by decomposing the carbonate by heating it in contact with an aqueous mixture of calcium hydrate, or by dissolving $NaHO$ in water.

SODII ACETAS, U. S.—Sodium Acetate. $NaC_2H_3O_2.3H_2O$; 135.74.—Large, colorless, transparent, monoclinic prisms or a granular crystalline powder; efflorescent in warm dry air; odorless; saline, bitter taste; neutral or faintly alkaline reaction. Made by decomposing sodium carbonate with acetic acid.

$$\underset{\text{Acetic Acid.}}{2HC_2H_3O_2} + \underset{\substack{\text{Sodium}\\\text{Carbonate.}}}{Na_2CO_3} = \underset{\text{Sodium Acetate.}}{2NaC_2H_3O_2} + \underset{\text{Water.}}{H_2O} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{CO_2}.$$

SODII ARSENAS, U. S.—Sodium Arsenate. $Na_2HAsO_4.7H_2O$; 311.46.—Colorless, transparent, prismatic crystals; slightly efflorescent in dry air; odorless; mild, feebly alkaline taste; faintly alkaline reaction. Made by heating together arsenious acid, sodium nitrate, and sodium carbonate.

The rationale of this process is, that when these three salts are fused together, sodium pyroarsenate is formed, while nitrous anhydride and carbon dioxide escape as gases.

$$\underset{\substack{\text{Arsenious}\\\text{Acid.}}}{As_2O_3} + \underset{\substack{\text{Sodium}\\\text{Nitrate.}}}{2NaNO_3} + \underset{\substack{\text{Sodium}\\\text{Carbonate.}}}{Na_2CO_3} = \underset{\substack{\text{Sodium}\\\text{Pyroarsenate.}}}{Na_4As_2O_7} + \underset{\substack{\text{Nitrous}\\\text{Anhydride.}}}{N_2O_3} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{CO_2}.$$

The sodium pyroarsenate is then converted into orthoarsenate by dissolving the former in water, filtering and crystallizing. The orthoarsenate is the official salt.

$$\underset{\substack{\text{Sodium}\\\text{Pyroarsenate.}}}{Na_4As_2O_7} + \underset{\text{Water.}}{15H_2O} = \underset{\text{Sodium Orthoarsenate.}}{2(Na_2HAsO_4.7H_2O)}.$$

SODII BENZOAS, U. S.—Sodium Benzoate. $NaC_7H_5O_2$; 143.71.—A white, semi-crystalline or amorphous powder; efflorescent on exposure to air; odorless, or having a faint odor of benzoin; sweetly astringent taste, free from bitterness; neutral reaction. Made by decomposing sodium carbonate with benzoic acid.

$$\underset{\text{Benzoic Acid.}}{2HC_7H_5O_2} + \underset{\substack{\text{Sodium}\\ \text{Carbonate.}}}{Na_2CO_3} = \underset{\substack{\text{Sodium}\\ \text{Benzoate.}}}{2NaC_7H_5O_2} + \underset{\substack{\text{Carbon}\\ \text{Dioxide.}}}{CO_2} + \underset{\text{Water.}}{H_2O.}$$

SODII BICARBONAS, U. S.—Sodium Bicarbonate. $NaHCO_3$; 83.85.—A white, opaque powder, permanent in dry, but slowly decomposed in moist air. When heated the salt is decomposed into normal carbonate, water, and carbon dioxide, and finally, at 100 ° C. (212° F.) loses about 36.3 p. c. of its weight; odorless; cooling; mildly alkaline taste; slightly alkaline reaction. Made by washing commercial sodium bicarbonate with water.

Sodium bicarbonate may also be prepared by Solvay's process. (See Sodium Carbonate.)

SODII BISULPHIS, U. S.—Sodium Bisulphite. $NaHSO_3$; 103.86.—Opaque, prismatic crystals, or a crystalline or granular powder; slowly oxidizing to sulphate, and losing sulphur dioxide on exposure to air; sulphur dioxide odor; disagreeable sulphurous taste; acid reaction. Made by saturating a solution of sodium carbonate with sulphurous acid.

$$\underset{\substack{\text{Sodium}\\ \text{Carbonate.}}}{Na_2CO_3} + \underset{\substack{\text{Sulphurous}\\ \text{Acid.}}}{2H_2SO_3} = \underset{\substack{\text{Sodium}\\ \text{Bisulphite.}}}{2NaHSO_3} + \underset{\substack{\text{Carbon}\\ \text{Dioxide.}}}{CO_2} + \underset{\text{Water.}}{H_2O.}$$

SODII BORAS, U. S.—Sodium Borate. $Na_2B_4O_7.10H_2O$; 380.92. (*Borax.*)—Colorless, transparent, shining, monoclinic prisms or a white powder; slightly efflorescent in dry air; odorless; sweetish alkaline taste; alkaline reaction. Made by purifying the neutral salts, found in immense quantities in California, as a crystalline deposit in the blue mud of an offset of Clear Lake. It is sometimes, also, called biborate of sodium, and is found native in Thibet, Persia, etc. Another name given it is *Tincal*. Tuscany is also a source of borax, where it occurs, principally, as crude boric acid.

SODII BROMIDUM, U. S.—Sodium Bromide. $NaBr$; 102.76. —Colorless, or white, cubical crystals, or a white granular powder; odorless; saline, slightly bitter, taste; neutral or faintly-alkaline reaction. From the air the salt attracts water without deliquescing. Made by treating ferrous bromide with sodium carbonate. The ferrous bromide is made by acting on iron wire with bromine, in the presence of water, and, after filtering, adding Na_2CO_3.

$$FeBr_2 + Na_2CO_3 = 2NaBr + FeCO_3.$$

SODII CARBONAS, U. S.—Sodium Carbonate. $Na_2CO_3.10H_2O$; 285.45.—Colorless, monoclinic crystals; rapidly efflorescing in dry air; and, if exposed soon loses about half of its water of crystallization (31.46 p. c. of its weight), and becomes a white powder; odorless; strongly alkaline taste; alkaline reaction; effervescing strongly with acids.

Sodium Carbonate is made by three processes, as follows :—

LEBLANC'S PROCESS.—Common salt is converted into sodium carbonate, in this process, by two steps.

First Step.—Salt is converted into sodium sulphate by sulphuric acid.

$$\underset{\substack{\text{Sodium}\\\text{Chloride.}}}{2NaCl} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{H_2SO_4} = \underset{\substack{\text{Sodium}\\\text{Sulphate.}}}{Na_2SO_4} + \underset{\substack{\text{Hydrochloric}\\\text{Acid.}}}{2HCl.}$$

Second Step.—The sodium sulphate, or *salt cake*, is decomposed by calcium carbonate and charcoal, at a high temperature, so as to yield sodium carbonate.

$$\underset{\substack{\text{Sodium}\\\text{Sulphate.}}}{Na_2SO_4} + \underset{\substack{\text{Calcium}\\\text{Carbonate.}}}{CaCO_3} + \underset{\text{Carbon}}{C_4} = \underset{\substack{\text{Sodium}\\\text{Carbonate.}}}{Na_2CO_3} + \underset{\substack{\text{Calcium}\\\text{Sulphide.}}}{CaS} + \underset{\substack{\text{Carbon}\\\text{Monoxide.}}}{4CO.}$$

The sulphate, first dried, is mixed with its own weight of limestone and half its weight of coal, and fused into a black mass. Sodium sulphate is converted by the coal into sodium sulphide, which reacts with the limestone (calcium carbonate), so as to form calcium sulphide and sodium carbonate. The black mass is now digested in warm water, which takes up the alkali and leaves the insoluble impurities, called soda waste, which is afterward used in the manufacture of sodium hyposulphite. By evaporating to dryness, a mass is obtained, which is calcined with sawdust, which converts the alkali—owing to the carbonic acid resulting from its combustion—fully into carbonate. Redissolving in water, and evaporating to dryness, gives the commercial salt. *Soda-ash*, contains about 50 per cent. of sodium carbonate.

SOLVAY'S PROCESS.—This process, also, has two steps, and is known as the ammonia-soda process.

First Step.—Carbon dioxide is passed into a solution of common salt in ammonia water, which results in a double decomposition. Sodium bicarbonate is precipitated and ammonium chloride remains in solution.

$$\underset{\substack{\text{Sodium}\\\text{Chloride.}}}{NaCl} + \underset{\text{Ammonia.}}{NH_3} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{CO_2} + \underset{\text{Water.}}{H_2O} = \underset{\substack{\text{Sodium}\\\text{Bicarbonate.}}}{HNaCO_3} + \underset{\substack{\text{Ammonium}\\\text{Chloride.}}}{NH_4Cl.}$$

Second Step.—Sodium bicarbonate is decomposed into sodium carbonate by heat.

$$\underset{\text{Sodium Bicarbonate.}}{2HNaCO_3} + \text{Heat} = \underset{\text{Sodium Carbonate.}}{Na_2CO_3} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2.}$$

CRYOLITE PROCESS.—Largely used in the United States. This process has also two steps.

First Step.—Cryolite, which consists, mainly, of a double fluoride of aluminium and sodium ($Al_2F_6.6NaF$), is heated with chalk. Calcium fluoride is formed, while the sodium and aluminium combine to form sodium aluminate, which is dissolved out by lixiviation.

$$\underset{\text{Cryolite.}}{(Al_2F_6.6NaF)} + \underset{\substack{\text{Calcium}\\\text{Carbonate.}}}{6CaCO_3} = \underset{\text{Sodium Aluminate.}}{2Na_3AlO_3} + \underset{\substack{\text{Calcium}\\\text{Fluoride.}}}{6CaF_2} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{6CO_2.}$$

Second Step.—The sodium aluminate is converted into carbonate by passing carbon dioxide, under pressure, through the solution. The alumina separates from the soda, becomes insoluble, and is deposited.

$$\underset{\text{Sodium Aluminate.}}{2Na_3AlO_3} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{3CO_2} = \underset{\substack{\text{Sodium}\\\text{Carbonate.}}}{3Na_2CO_3} + \underset{\text{Alumina.}}{Al_2O_3.}$$

SODII CARBONAS EXSICCATUS, U. S.—Dried Sodium Carbonate.—A white, hygroscopic powder, made by heating the carbonate.

SODII CHLORAS, U. S.—Sodium Chlorate. $NaClO_3$; 106.25—Colorless, transparent crystals (principally regular cubes, with tetrahedral facets), or a crystalline powder, permanent in dry air; odorless; saline taste; neutral reaction. Made by double decomposition, between sodium bitartrate and potassium chlorate. (Wittstein's process.)

The details of the process are as follows:—

First, acid sodium tartrate is prepared by decomposing sodium carbonate with tartaric acid.

$$\underset{\substack{\text{Sodium}\\ \text{Carbonate.}}}{Na_2CO_3} + \underset{\substack{\text{Tartaric}\\ \text{Acid.}}}{2H_2C_4H_4O_6} = \underset{\substack{\text{Acid Sodium}\\ \text{Tartrate.}}}{2NaHC_4H_4O_6} + \underset{\substack{\text{Carbon}\\ \text{Dioxide.}}}{CO_2} + \underset{\text{Water.}}{H_2O.}$$

Then the acid sodium tartrate is added to the potassium chlorate:—

$$\underset{\substack{\text{Acid Sodium}\\ \text{Tartrate.}}}{NaHC_4H_4O_6} + \underset{\substack{\text{Potassium}\\ \text{Chlorate.}}}{KClO_3} = \underset{\substack{\text{Sodium}\\ \text{Chlorate.}}}{NaClO_3} + \underset{\substack{\text{Acid Potassium}\\ \text{Tartrate.}}}{KHC_4H_4O_6.}$$

SODII CHLORIDUM, U. S.—Sodium Chloride. $NaCl$; 58.37. (*Common Salt.*)—Cubical crystals or a white crystalline powder, permanent in dry air; odorless; purely saline taste; neutral reaction. Obtained by evaporating sea water, and the salt from salt wells, springs, etc.

SODII HYPOPHOSPHIS, U. S.—Sodium Hypophosphite. $NaH_2PO_2.H_2O$; 105.84.—Small, colorless, transparent, rectangular plates, of a pearly lustre or a white, granular powder, very deliquescent on exposure to the air; odorless; bitterish-sweetish, saline taste; neutral reaction. Made by double decomposition between calcium hypophosphite and sodium carbonate.

$$\underset{\substack{\text{Calcium}\\ \text{Hypophosphite}}}{Ca(H_2PO_2)_2} + \underset{\substack{\text{Sodium}\\ \text{Carbonate.}}}{Na_2CO_3} = \underset{\substack{\text{Sodium}\\ \text{Hypophosphite.}}}{2NaH_2PO_2} + \underset{\substack{\text{Calcium}\\ \text{Carbonate.}}}{CaCO_3.}$$

Sometimes this salt explodes with violence during evaporation; this is supposed to be due to the employment of too much heat. Evaporation should, therefore, be performed below 100° C. (212° F.).

$$\underset{\substack{\text{Sodium}\\ \text{Hypophosphite.}}}{5NaH_2PO_2} = \underset{\substack{\text{Sodium}\\ \text{Pyrophosphate.}}}{Na_4P_2O_7} + \underset{\substack{\text{Sodium}\\ \text{Metaphosphate.}}}{NaPO_3} + \underset{\substack{\text{Phosphoretted}\\ \text{Hydrogen.}}}{2PH_3} + \underset{\text{Hydrogen.}}{2H_2.}$$

Hydrogen and phosphoretted hydrogen are evolved, the latter being spontaneously inflammable.

Hypophosphorous acid is the acid present in this salt.

SODII HYPOSULPHIS, U. S.—"Sodium Hyposulphite." $Na_2S_2O_3.5H_2O$; 247.64. (*Sodium Thiosulphate.*)—Colorless, transparent, monoclinic prisms. Permanent in the air below 33° C. (91.4° F.), but efflorescent in dry air above that temperature; odorless; cooling, somewhat bitter taste; neutral reaction. Made by decomposing calcium thiosulphate with sodium sulphate.

$$\underset{\substack{\textit{Calcium}\\ \textit{Thiosulphate.}}}{CaS_2O_3} + \underset{\substack{\text{Sodium}\\ \text{Sulphate.}}}{Na_2SO_4} = \underset{\substack{\text{Sodium}\\ \text{Thiosulphate.}}}{Na_2S_2O_3} + \underset{\substack{\text{Calcium}\\ \text{Sulphate.}}}{CaSO_4.}$$

SODII IODIDUM, U. S.—Sodium Iodide. NaI; 149.53.—Colorless cubical crystals, or a white crystalline powder; in moist air it deliquesces and becomes partially decomposed into sodium carbonate and free iodine, assuming, thereby, a reddish color; odorless; saline, and slightly bitter taste; neutral or faintly alkaline reaction. Made by treating ferrous iodide with sodium carbonate.

$$\underset{\substack{\text{Ferrous}\\\text{Iodide.}}}{FeI_2} + \underset{\substack{\text{Sodium}\\\text{Carbonate.}}}{Na_2CO_3} = \underset{\substack{\text{Sodium}\\\text{Iodide.}}}{2NaI} + \underset{\substack{\text{Ferrous}\\\text{Carbonate.}}}{FeCO_3}.$$

SODII NITRAS, U. S.—Sodium Nitrate. $NaNO_3$; 84.89. (*Cubic Nitre. Chili Saltpetre.*)—Found in Chili and Peru.

Colorless, transparent, rhombohedral crystals, deliquescent in damp air; odorless; cooling, saline, and slightly bitter taste; neutral reaction. Made by purifying the native salt.

It is the cheapest source for obtaining nitrates.

SODII NITRIS, U. S.—Sodium Nitrite. $NaNO_2$; 68.93.—White, opaque, fused masses, usually in the form of pencils, or colorless, transparent, hexagonal crystals; odorless, mild, saline taste, alkaline reaction.

SODII PHOSPHAS, U. S.—Sodium Phosphate. $Na_2HPO_4 \cdot 12H_2O$; 357.32.—Large, colorless, transparent, monoclinic prisms. The crystals effloresce in the air, and gradually lose five molecules of their water of crystallization (25.1 p. c.); odorless; cooling, saline taste; slightly alkaline reaction. Made by treating acid calcium phosphate with sodium carbonate. The details of the process are as follows:—

Acid calcium phosphate is made from bones, by treating them with sulphuric acid, after thorough calcination. To the concentrated liquid obtained by boiling this solution down, carbonate of sodium is added until the phosphoric acid is completely saturated. The liquid is then filtered and set aside to crystallize.

Details.—Bones consist of neutral calcium phosphate and animal matter. The latter is separated by burning them to whiteness, leaving a powder called bone phosphate or bone ash, associated with some calcium carbonate. When this is mixed with sulphuric acid, the calcium carbonate is decomposed, giving rise to effervescence. The calcium phosphate undergoes partial decomposition; the greater part of the lime being liberated, precipitates as calcium sulphate, while the phosphoric acid combines with the undecomposed portions of the phosphate, and remains in solution as an acid calcium phosphate, holding dissolved a small portion of calcium sulphate.

$$\underset{\substack{\text{Calcium}\\\text{Phosphate.}}}{Ca_3(PO_4)_2} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{2H_2SO_4} = \underset{\substack{\text{Acid Calcium}\\\text{Phosphate.}}}{CaH_42PO_4} + \underset{\substack{\text{Calcium}\\\text{Sulphate.}}}{2CaSO_4}.$$

"In order to separate the acid phosphate from the precipitated mass of calcium sulphate, boiling water is added to the mixture. The whole is strained, and the sulphate washed as long as acid phosphate is removed, which is known by the water passing through in an acid state. The different liquids which have passed the strainer, consisting of the solution of acid calcium phosphate, are mixed and allowed to stand, and, by cooling, a portion of calcium sulphate is deposited, which is got rid of by decantation. The bulk of the liquid is now reduced by evaporation, and, in consequence of the diminution of water, a fresh portion of calcium sulphate is deposited, which is separated by subsidence and decantation, as before. The acid calcium phosphate solution being heated, is now saturated by means of a hot solution of sodium carbonate, the carbonic acid is liberated with effervescence, and the alkali, combining with the excess of acid of the acid phosphate, produces sodium phosphate, while the acid calcium phosphate, by the loss of its excess of acid, becomes the neutral phosphate, and precipitates.

$$\underset{\text{Acid Calcium Phosphate.}}{CaH_4 2PO_4} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Calcium Phosphate.}}{CaHPO_4} + \underset{\text{Sodium Phosphate.}}{Na_2HPO_4} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

"The calcium phosphate is separated by filtration, and the filtered liquor, which is a solution of sodium phosphate, is evaporated, so as to crystallize."—(Remington.)

SODII PYROPHOSPHAS, U. S.—Sodium Pyrophosphate. $Na_4P_2O_7.10H_2O$; 445.24.—Colorless, transparent, monoclinic prisms, or a crystalline powder; permanent in cool, slightly efflorescent in warm air. Odorless; cooling, saline and feebly alkaline taste; slightly alkaline reaction. Made by heating sodium phosphate to redness, dissolving and crystallizing.

SODII SALICYLAS, U. S.—Sodium Salicylate. $NaC_7H_5O_3$; 159.67.—A white, amorphous powder, permanent in cool air. Odorless; sweetish, saline taste; feebly acid reaction. Made by decomposing sodium carbonate with salicylic acid.

$$\underset{\text{Salicylic Acid.}}{2HC_7H_5O_3} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Sodium Salicylate.}}{2NaC_7H_5O_3} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

SODII SULPHAS, U. S.—Sodium Sulphate. $Na_2SO_4.10H_2O$; 321.42. (*Glauber's Salt.*)—Large, colorless, transparent, monoclinic prisms or granular crystals, rapidly efflorescing on exposure to air, and ultimately falling into a white powder; insoluble in alcohol; odorless; saline and somewhat bitter taste; neutral reaction. Made by treating common salt with sulphuric acid.

SODII SULPHIS, U. S.—Sodium Sulphite. $Na_2SO_3.7H_2O$; 251.58.—Colorless, transparent, monoclinic prisms; efflorescent in dry air, and is slowly oxidized to sulphate; odorless; cooling, saline and sulphurous taste; neutral or feebly alkaline reaction. Made by decomposing sodium carbonate with sulphurous acid.

$$\underset{\text{Sodium Carbonate.}}{Na_2CO_3} + \underset{\text{Sulphurous Acid.}}{SO_2} = \underset{\text{Sodium Sulphite.}}{Na_2SO_3} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

SODII SULPHOCARBOLAS, U. S.—Sodium Sulphocarbolate. $NaSO_3C_6H_4(OH).2H_2O$; 231.56.—Colorless, transparent, rhombic prisms; slightly efflorescent in dry air; odorless, or nearly so; cooling, saline, somewhat bitter taste; neutral reaction. Made by double decomposition between barium sulphocarbolate and sodium carbonate.

The details of the process are as follows: Carbolic acid and strong sulphuric acid are mixed together, which produces sulphocarbolic acid, $C_6H_5HSO_4$. After submitting the mixed liquids to a temperature of 55°

C. (131° F.) for several days, the product is diluted in water. It is then mixed with barium carbonate gradually until effervescence ceases. Barium sulphate is precipitated also by any carbonate which may be present, and the liquor filtered. The solution of barium sulphocarbolate is now decomposed by a sodium carbonate. The liquor is filtered from barium carbonate and sodium sulphocarbolate obtained by evaporating and crystallizing.

$$\underset{\text{Carbolic Acid.}}{C_6H_5HO} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Sulphocarbolic Acid.}}{HC_6H_5SO_4} + \underset{\text{Water.}}{H_2O}.$$

LITHIUM. Li; 7.

LITHII BENZOAS, U. S.—Lithium Benzoate. $LiC_7H_5O_2$; 127.72—A white powder, or small, shining, crystalline scales; permanent in the air; odorless, or having a faintly benzoin-like odor; cooling and sweetish taste; faintly acid reaction; made by treating lithium carbonate with benzoic acid.

$$\underset{\text{Lithium Carbonate.}}{Li_2CO_3} + \underset{\text{Benzoic Acid.}}{2HC_7H_5O_2} = \underset{\text{Lithium Benzoate.}}{2LiC_7H_5O_2} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

LITHII BROMIDUM, U. S.—Lithium Bromide. LiBr; 86.77.—A white, granular salt, very deliquescent; odorless; sharp, somewhat bitter taste; neutral reaction. Made by decomposing ferrous bromide with lithium carbonate.

$$\underset{\text{Ferrous Bromide.}}{FeBr_2} + \underset{\text{Lithium Carbonate.}}{Li_2CO_3} = \underset{\text{Lithium Bromide.}}{2LiBr} + \underset{\text{Ferrous Carbonate.}}{FeCO_3}.$$

LITHII CARBONAS, U. S.—Lithium Carbonate. Li_2CO_3; 73.87.—A light, white powder; permanent in the air; odorless; alkaline taste; alkaline reaction. Made by precipitating lithium sulphate with ammonium carbonate.

LITHII CITRAS U. S.—Lithium Citrate. $Li_3C_6H_5O_7$; 209.57.—A white powder; deliquescent on exposure to air; odorless; cooling, faintly alkaline taste; neutral reaction. Made by decomposing the carbonate with citric acid.

$$\underset{\text{Lithium Carbonate.}}{3Li_2CO_3} + \underset{\text{Citric Acid.}}{2H_3C_6H_5O_7} = \underset{\text{Lithium Citrate.}}{2Li_3C_6H_5O_7} + \underset{\text{Water.}}{3H_2O} + \underset{\text{Carbon. Dioxide.}}{3CO_2}.$$

LITHII CITRAS EFFERVESCENS, U. S.—Effervescent Lithium Citrate.—Made by triturating 370 Gm. citric acid, with about 200 Gm. sugar, drying the mixture, and incorporating with it, by trituration, 70 Gm. Lith. Carb., and 280 Gm. Sodium Bicarb. with Sugar q. s. ft. 1000 Gm.

LITHII SALICYLAS, U. S.—Lithium Salicylate. $LiC_7H_5O_3$; 143.68.—A white, or grayish white powder; deliquescent on exposure to air; odorless, sweetish taste; faintly acid reaction. Made by decomposing lithium carbonate with salicylic acid.

$$\underset{\text{Lithium Carbonate.}}{Li_2CO_3} + \underset{\text{Salicylic Acid.}}{2HC_7H_5O_3} = \underset{\text{Lithium Salicylate.}}{2LiC_7H_5O_3} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

AMMONIUM. NH_4.

AQUA AMMONIÆ, U. S.—Ammonia Water.—A colorless, transparent liquid; very pungent odor; acrid, alkaline taste; strongly alkaline reaction, consisting of an aqueous solution of ammonia (NH_3), containing 10 per cent. by weight of the gas. Made by mixing ammonium chloride with milk of lime, and distilling over the gas into distilled water. The reaction is as follows:—

$$\underset{\substack{\text{Ammonium}\\\text{Chloride.}}}{2NH_4Cl} + \underset{\substack{\text{Calcium}\\\text{Hydrate.}}}{Ca(HO)_2} = \underset{\text{Ammonia.}}{2NH_3} + \underset{\substack{\text{Calcium}\\\text{Chloride.}}}{CaCl_2} + \underset{\text{Water.}}{2H_2O.}$$

AQUA AMMONIÆ FORTIOR, U. S.—Stronger Ammonia Water.—28 per cent. by weight aqueous solution NH_3. Sp. gr. 0.901, at 15° C (59° F.).

SPIRITUS AMMONIÆ, U. S.—Spirit of Ammonia.—An alcoholic solution of ammonia containing 10 per cent. by weight of the gas.

SPIRITUS AMMONIÆ AROMATICUS, U. S.—Aromatic Spirit of Ammonia.—An aromatic hydro-alcoholic solution of ammonium carbonate. (See Spiritus, Part II.)

LIQUOR AMMONII ACETATIS, U. S.—Solution of Ammonium Acetate. (*Spirit of Mindererus.*)—An aqueous solution of Ammonium Acetate ($NH_4C_2H_3O_2$; 76.87), containing about 7 per cent. of the salt, together with small amounts of acetic and carbonic acid. A clear, colorless liquid, free from empyreuma; mildly saline taste; neutral, or slightly acid reaction. Made by mixing solution of acetic acid and ammonium carbonate.

$$\underset{\substack{\text{Acid Ammonium Carbonate}\\\text{and Carbamate.}}}{(NH_4HCO_3)NH_4NH_2CO_2} + \underset{\text{Acetic Acid.}}{3HC_2H_3O_2} =$$

$$\underset{\substack{\text{Ammonium}\\\text{Acetate.}}}{3NH_4C_2H_3O_2} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{2CO_2} + \underset{\text{Water.}}{H_2O.}$$

AMMONII BENZOAS, U. S.—Ammonium Benzoate. $NH_4C_7H_5O_2$; 138.72.—Thin, white, four-sided, laminar crystals, gradually losing ammonia on exposure to the air; slight odor of benzoic acid; saline, bitter, afterward slightly acrid taste; neutral or slightly acid reaction. Made by dissolving benzoic acid in water of ammonia.

$$\underset{\substack{\text{Benzoic}\\\text{Acid.}}}{HC_7H_5O_2} + \underset{\substack{\text{Ammonia}\\\text{Water.}}}{NH_4HO} = \underset{\substack{\text{Ammonium}\\\text{Benzoate.}}}{NH_4C_7H_5O_2} + \underset{\text{Water.}}{H_2O.}$$

AMMONII BROMIDUM, U. S.—Ammonium Bromide. NH_4Br; 97.77.—Colorless, transparent, prismatic crystals, or a white crystalline powder permanent in the air; odorless, pungent, saline taste; slightly acid reaction. Made by adding water of ammonia, gradually, to bromine, under water. (Pile's Process.)

$$\underset{\text{Bromine.}}{6Br} + \underset{\text{Ammonia.}}{8NH_3} = \underset{\substack{\text{Ammonium}\\\text{Bromide.}}}{6NH_4Br} + \underset{\text{Nitrogen.}}{N_2.}$$

AMMONII CARBONAS, U. S.—Ammonium Carbonate. $NH_4HCO_3.NH_4NH_2CO_2$; 156.77.—White, hard, translucent, striated masses, which lose both ammonia and carbonic acid gas on exposure to air, becoming opaque and finally converted into friable, porous lumps, or a white powder (acid ammonium carbonate); strongly ammoniacal odor, free from empyreuma; sharp, saline taste; strongly alkaline reaction and effervesces with acids. Made by subliming a mixture of ammonium chloride and calcium carbonate.

$$\underset{\text{Ammonium Chloride.}}{4NH_4Cl} + \underset{\text{Calcium Carbonate.}}{2CaCO_3} = \underset{\text{Ammonium Carbonate.}}{NH_4HCO_3.NH_4NH_2CO_2} +$$

$$\underset{\text{Calcium Chloride.}}{2CaCl_2} + \underset{\text{Ammonia.}}{NH_3} + \underset{\text{Water.}}{H_2O.}$$

AMMONII CHLORIDUM, U. S. — Ammonium Chloride. NH_4Cl; 53.38. (*Sal Ammoniac.*)—A white, crystalline powder, permanent in the air; odorless; cooling, saline taste; aqueous solution has a neutral reaction. Made by subliming a mixture of ammonium sulphate and sodium chloride.

This salt is chiefly made from the gas liquor from gas works.

AMMONII IODIDUM, U. S.—Ammonium Iodide. NH_4I; 144.54.—Minute, colorless, cubical crystals, or a white, granular powder; very hygroscopic and soon becoming yellow or yellowish brown on exposure to the air and light, owing to the loss of ammonia, and the elimination of iodine; odorless when white, but emitting a slight odor of iodine when colored; sharp, saline taste; neutral reaction. Made by mixing solutions of potassium iodide and ammonium sulphate.

$$\underset{\text{Potassium Iodide.}}{2KI} + \underset{\text{Ammonium Sulphate.}}{(NH_4)_2SO_4} = \underset{\text{Ammonium Iodide.}}{2NH_4I} + \underset{\text{Potassium Sulphate.}}{K_2SO_4.}$$

AMMONII NITRAS, U. S.—Ammonium Nitrate. NH_4NO_3; 79.9.—Colorless crystals, generally in the form of long, thin, rhombic prisms, or fused masses; somewhat deliquescent; odorless; sharp, bitter taste; neutral reaction. Made by treating ammonium carbonate with nitric acid.

$$\underset{\text{Acid Ammonium Carbonate and Carbamate.}}{(NH_4HCO_3)NH_4NH_2CO_2} + \underset{\text{Nitric Acid.}}{3HNO_3} =$$

$$\underset{\text{Ammonium Nitrate.}}{3NH_4NO_3} + \underset{\text{Carbon Dioxide.}}{2CO_2} + \underset{\text{Water.}}{H_2O.}$$

AMMONII VALERIANAS, U. S.—Ammonium Valerianate. $NH_4C_5H_9O_2$; 118.78.—Colorless, or white, quadrangular plates, deliquescent in moist air; valerianic acid odor; sharp and sweetish taste; neutral reaction. Made by passing ammonia gas into monohydrated valerianic acid.

The salt found in commerce is, usually, the acid salt, and should be neutralized with ammonia when used in solution for making preparations.

MAGNESIUM, CALCIUM, BARIUM, AND STRONTIUM.

MAGNESIUM. M

MAGNESIA, U. S.—Magn
sia.)—A white, very light and v

ture and carbon dioxide from the air; odorless; an earthy, but no saline, taste; faintly alkaline reaction when moistened with water. Made by calcining light magnesium carbonate.

$$\underset{\text{Magnesium Carbonate.}}{(MgCO_3)_4.Mg(HO)_2.5H_2O} + \text{heat} = \underset{\text{Magnesia.}}{5MgO} + \underset{\text{Carbon Dioxide.}}{4CO_2} + \underset{\text{Water.}}{6H_2O.}$$

MAGNESIA PONDEROSA, U. S.—Heavy Magnesia. MgO; 40.26.—A white, dense and very fine powder, corresponding, in all other properties and reactions, with magnesia. Made by calcining heavy magnesium carbonate.

MAGNESII CARBONAS, U. S.—Magnesium Carbonate. $(MgCO_3)_4.Mg(HO)_2.5H_2O$; 484.62.—Light, white, friable masses, or a light, white powder, permanent in the air; odorless; slightly earthy taste; feebly alkaline reaction. Made by double decomposition between magnesium sulphate and sodium carbonate.

$$\underset{\text{Magnesium Sulphate.}}{5MgSO_4} + \underset{\text{Sodium Carbonate.}}{5Na_2CO_3} + \underset{\text{Water.}}{H_2O} =$$

$$\underset{\text{Magnesium Carbonate.}}{(MgCO_3)_4.Mg(HO)_2} + \underset{\text{Sodium Sulphate.}}{5Na_2SO_4} + \underset{\text{Carbon Dioxide.}}{CO_2.}$$

The process for making light magnesium carbonate differs in nothing from the above, except that it is made with a cold dilute solution instead of a concentrated boiling solution, thus illustrating the general rule in precipitation, that dilute solutions produce light precipitates, and dense solutions heavy precipitates.

MAGNESII CITRAS EFFERVESCENS, U. S.—Effervescent Magnesium Citrate.—A white, coarsely-granular salt, deliquescent on exposure to air; odorless; mildly acidulous, refreshing taste; acid reaction. Made from magnesium carbonate, citric acid, sodium bicarbonate, sugar, alcohol and distilled water. The carbonate of magnesia and part of the citric acid are rubbed together in the form of a thick paste, with distilled water, dried and powdered. The sugar, bicarbonate of sodium and the remainder of the citric acid, previously reduced to a fine powder, are then mixed with it. The mass is then dampened with alcohol and rubbed into a coarse, granular powder, through a sieve.

MAGNESII SULPHAS, U. S.—Magnesium Sulphate. $MgSO_4.7H_2O$; 245.84. (*Epsom Salt.*)—Small, colorless, rhombic prisms, or acicular crystals, slowly efflorescent in dry air; odorless; cooling, saline and bitter taste; neutral reaction. Made by treating native magnesium hydrate with sulphuric acid.

Native magnesium hydrate is found in the United States, and is a silicious hydrate, practically free from lime. The mineral is treated with the acid, dried, and calcined, in order to convert into red oxide any ferrous sulphate which may be present. It is then dissolved in water, and calcium sulphide added to separate any remaining portion of iron. Purified by recrystallization.

Dolomite, the double carbonate of magnesium and calcium, is used in *England for preparing* Epsom salts. The carbon dioxide is driven off by heat, converting the residue into hydrates, which are treated with HCl. The calcium chloride formed by this reaction is dissolved out from the magnesium salt with water, and the latter converted into sulphate by treating it with sulphuric acid.

LIQUOR MAGNESII CITRATIS, U. S.—Solution of Magnesium Citrate.—Made by dissolving magnesium carbonate in citric acid, flavoring and adding potassium bicarbonate.

CALCIUM. Ca; 39.91.

CALX, U. S.—Lime. CaO; 55.87.—Hard, white, or grayish-white, masses, gradually attracting moisture and carbon dioxide on exposure to air, and falling to a white powder; odorless; sharp, caustic taste; alkaline reaction. Made by calcining chalk or limestone.

LIQUOR CALCIS, U. S.—Solution of Lime. (*Lime Water*).—A clear, colorless liquid; odorless; saline, and feebly caustic taste; alkaline reaction. Made by dissolving lime in water. Contains about 0.17 per cent. of hydrate of calcium. Varies with temperature.

Syrup of Lime (Saccharine Solution), and Lime Liniment (Carron Oil), (see Part II). Calx Chlorata (see Chlorine).

CALX SULPHURATA, U. S.—Sulphurated Lime.—A pale gray powder, gradually altered by exposure to air, exhaling a faint odor of hydrogen sulphide; offensive, alkaline taste; alkaline reaction. A mixture containing at least 60 per cent. of Calcium Monosulphide (CaS; 71.89), together with unchanged Calcium Sulphate ($CaSO_4$; 135.73), and Carbon, in varying proportions. Made by heating lime and sulphur to a low, red heat.

CALCII BROMIDUM, U. S.—Calcium Bromide. $CaBr_2$; 199.43.—A white, granular salt; very deliquescent; odorless; pungent, sharp saline taste; neutral reaction. Made by dissolving calcium carbonate in hydrobromic acid.

$$\underset{\substack{\text{Calcium}\\ \text{Carbonate.}}}{CaCO_3} + \underset{\substack{\text{Hydrobromic}\\ \text{Acid.}}}{2HBr} = \underset{\substack{\text{Calcium}\\ \text{Bromide.}}}{CaBr_2} + \underset{\text{Water.}}{H_2O} + \underset{\substack{\text{Carbon}\\ \text{Dioxide.}}}{CO_2}.$$

CALCII CARBONAS PRÆCIPITATUS, U. S.—Precipitated Calcium Carbonate. $CaCO_3$; 99.76.—A fine, white powder, permanent in the air; odorless and tasteless. Made by double decomposition between calcium chloride and sodium carbonate.

$$\underset{\substack{\text{Calcium}\\ \text{Chloride.}}}{CaCl_2} + \underset{\substack{\text{Sodium}\\ \text{Carbonate.}}}{Na_2CO_3} = \underset{\substack{\text{Calcium}\\ \text{Carbonate.}}}{CaCO_3} + \underset{\substack{\text{Sodium}\\ \text{Chloride.}}}{2NaCl}.$$

Precipitated calcium carbonate is also known as Precipitated Chalk.

CRETA PRÆPARATA, U. S.—Prepared Chalk.—A white, amorphous powder, generally agglutinated in the form of small con

manent in the air; odorless and tasteless.

Prepared chalk is made from the native friable carbon

(CaCO_3), freed from most of its impurities by elutriation.

Part I.)

CALCII CHLORIDUM, U. S.—Calcium C

110.65.—White, slightly translucent, hard fragments, odorless; sharp, saline taste; neutral, or faintly alkaline reaction. Made by acting on calcium carbonate with hydrochloric acid.

$$\underset{\substack{\text{Calcium}\\ \text{Carbonate.}}}{CaCO_3} + \underset{\substack{\text{Hydrochloric}\\ \text{Acid.}}}{2HCl} = \underset{\substack{\text{Calcium}\\ \text{Chloride.}}}{CaCl_2} + \underset{\substack{\text{Carbon}\\ \text{Dioxide.}}}{CO_2} + \underset{\text{Water.}}{H_2O.}$$

CALCII HYPOPHOSPHIS, U. S.—Calcium Hypophosphite. $Ca(PH_2O_2)_2$; 169.67.—Colorless, transparent, monoclinic prisms, or small, lustrous scales, or a white, crystalline powder, permanent in dry air; odorless; nauseous, bitter taste; neutral reaction. Made by heating phosphorus with milk of lime.

$$\underset{\text{Phosphorus.}}{8P} + \underset{\substack{\text{Calcium}\\ \text{Hydrate.}}}{3Ca(HO)_2} + \underset{\text{Water.}}{6H_2O} = \underset{\substack{\text{Calcium}\\ \text{Hypophosphite.}}}{3Ca(H_2PO_2)_2} + \underset{\substack{\text{Phosphoretted}\\ \text{Hydrogen.}}}{2PH_3.}$$

It is necessary to provide for the safe escape of the phosphoretted hydrogen gas evolved in this reaction, by conducting it, by a hood, into a powerful draught. No higher heat than 85° C. (185° F.) should be used, for fear of explosion.

CALCII PHOSPHAS PRÆCIPITATUS, U. S.—Precipitated Calcium Phosphate. $Ca_3(PO_4)_2$; 309.33.—A large, white, amorphous powder, permanent in the air; odorless and tasteless. Made by treating bone ash with HCl, and precipitating it with ammonia.

CALCII SULPHAS EXSICCATUS, U. S.—Dried Calcium Sulphate. (*Dried Gypsum.*)—A powder containing about 95 per cent., by weight, of Calcium Sulphate ($CaSO_4$; 135.73), and about 5 per cent. of Water; prepared from the purer varieties of native gypsum ($CaSO_4.2H_2O$; 171.65), by carefully heating until about three-fourths of the water has been expelled. Occurring as a fine, white powder, without odor or taste. Keep dry.

For Syr. Hypophos., Syr. Hypophos. with Iron, Syr. Calcis Lactophos., Pulvis Cretæ Comp., Mistura Cretæ, and Troches of Chalk, see Part II.

BARIUM. Ba; 136.8.

This element furnishes to the Pharmacopœia one salt and two test-solutions.

BARII DIOXIDI, U. S.—Barium Dioxide, BaO_2; 168.72. (*Barium Peroxide*).—Commercial anhydrous Barium Dioxide. It should be kept in well-closed vessels. A heavy, grayish-white, or pale yellowish-white, amorphous, coarse powder. Odorless and tasteless, alkaline reaction, almost insoluble in water, but decomposed by mineral acids, with the formation of corresponding salts and hydrogen dioxide, which remains in solution for a considerable time, if the reaction has taken place in the cold and an excess of the acid is present. The dioxide is prepared by heating the oxide to about 450° C. (842° F.) which causes it to take up another atom of Oxygen.

PREPARATION: Aqua Hydrogenii Dioxidi.

STRONTIUM. Sr; 87.3.

STRONTII BROMIDUM, U. S.—Strontium Bromide. $SrBr_2.6H_2O$; *354.58.—Colorless*, transparent, hexagonal crystals; odorless, *and having a bitter,* saline taste. Very deliquescent. Soluble in 1.05

parts of water at 15° C. (59° F.), and in 0.5 parts of boiling water. It is readily soluble in alcohol. Made by dissolving the carbonate in hydrobromic acid, evaporating and crystallizing.

STRONTII IODIDUM, U. S.—Strontium Iodide. $SrI_2.6H_2O$; 448.12.—Colorless, transparent, hexagonal plates; odorless, and having a bitterish saline taste. Deliquescent, and colored yellow by exposure to light and air. Solution in 0.6 part of water at 15° C. (59° F)., and in 0.27 part of boiling water. Also soluble in alcohol. Made by evaporating a solution of strontium hydrate in hydroiodic acid.

STRONTII LACTAS, U. S.—Strontium Lactate. $Sr(C_3H_5O_3)_2.3H_2O$; 318.76.—A white, granular powder, or crystalline nodules; odorless, and having a slightly bitter, saline taste. Permanent in the air. Soluble in about 4 parts water at 15° C. (59° F.), and in less than 0.5 part of boiling water. Soluble in alcohol. Made by dissolving freshly-precipitated strontium carbonate in lactic acid, filtering, evaporating, and granulating.

ZINC, ALUMINIUM, CERIUM AND CADMIUM.

ZINCUM, U. S.—ZINC. Zn; 65.10.

Metallic zinc, in the form of thin sheets, or irregular, granulated pieces. Prepared by roasting calamine (impure carbonate) with charcoal, and collecting the zinc vapors in water. A bluish-white metal. Used in making H and in preparing the Zn salts.

ZINCI ACETAS, U. S.—Zinc Acetate $Zn(C_2H_3O_2)_2.2H_2O$; 218.74.—Soft, white, six-sided, monoclinic plates, of a pearly lustre, somewhat efflorescent in dry air, losing some of its acid; faintly acetous odor; astringent, metallic taste; acid reaction. Made by heating zinc oxide with acetic acid.

$$\underset{\text{Zinc Oxide.}}{ZnO_2} + \underset{\text{Acetic Acid.}}{2HC_2H_3O_2} = \underset{\text{Zinc Acetate.}}{Zn(C_2H_3O_2)_2} + \underset{\text{Water.}}{H_2O.}$$

ZINCII BROMIDUM, U. S.—Zinc Bromide. $ZnBr_2$; 224.62.—A white, granular powder, very deliquescent; odorless; sharp, saline and metallic taste; slightly acid reaction. Made by double decomposition of zinc sulphate and potassium bromide.

$$\underset{\substack{\text{Zinc}\\ \text{Sulphate.}}}{ZnSO_4} + \underset{\substack{\text{Potassium}\\ \text{Bromide.}}}{2KBr} = \underset{\substack{\text{Zinc}\\ \text{Bromide.}}}{ZnBr_2} + \underset{\substack{\text{Potassium}\\ \text{Sulphate.}}}{K_2SO_4.}$$

ZINCI CARBONAS PRÆCIPITATUS, U. S.—Precipitated Zinc Carbonate.—A white, impalpable powder, of somewhat variable chemical composition; permanent in the air; odorless and tasteless. Made by double decomposition of zinc sulphate and sodium carbonate.

$$\underset{\substack{\text{Sodium}\\ \text{Carbonate.}}}{5Na_2CO_3} + \underset{\substack{\text{Zinc}\\ \text{Sulphate.}}}{5ZnSO_4} + \underset{\text{Water.}}{3H_2O} =$$

$$\underset{\text{Zinc Carbonate.}}{(ZnCO_3)_2.3Zn(HO)_2} + \underset{\substack{\text{Sodium}\\ \text{Sulphate.}}}{5Na_2SO_4} + \underset{\substack{\text{Carbon}\\ \text{Dioxide.}}}{3CO_2.}$$

Conduct at boiling heat, to prevent loss by the action of the CO_2 on the neutral carbonate, which occurs if cold solutions are used.

ZINCI CHLORIDUM, U. S.—Zinc Chloride. $ZnCl_2$; 135.84.—A white granular powder, or porcelain-like masses, irregular, or moulded into pencils, very deliquescent; odorless; very caustic, astringent and metallic taste; acid reaction. Made by evaporating the official solution of chloride of zinc.

$$\underset{\text{Zinc.}}{2Zn} + \underset{\substack{\text{Hydrochloric}\\ \text{Acid.}}}{4HCl} = \underset{\substack{\text{Zinc}\\ \text{Chloride.}}}{2ZnCl_2} + \underset{\text{Hydrogen.}}{4H.}$$

LIQUOR ZINCI CHLORIDI, U. S.—Solution of Zinc Chloride. (*Burnett's Disinfecting Fluid.*)—An aqueous solution of $ZnCl_2$ containing about 50 per cent. of the salt. Made by heating zinc with hydrochloric acid.

$$\underset{\text{Zinc.}}{2Zn} + \underset{\substack{\text{Hydrochloric}\\ \text{Acid.}}}{4HCl} = \underset{\substack{\text{Zinc}\\ \text{Chloride.}}}{2ZnCl_2} + \underset{\text{Hydrogen.}}{4H.}$$

ZINCI IODIDUM, U. S.—Zinc Iodide. ZnI_2; 318.16.—A white, granular powder, very deliquescent, and liable to absorb oxygen from the air, and to become brown from liberated iodine; odorless; sharp, saline and metallic taste; acid reaction. Made by digesting zinc with iodine diffused in water.

$$\underset{\text{Zinc.}}{Zn} + \underset{\text{Iodine.}}{I_2} = ZnI_2.$$

ZINCI OXIDUM, U. S.—Zinc Oxide. ZnO; 81.06.—An amorphous white powder. It gradually absorbs carbon dioxide from the air; odorless and tasteless. Made by calcining zinc carbonate.

On the large scale, this salt is made by heating calamine and coal together, and separating the impurities by blowing the mixed vapors up a large tower, allowing the heavier particles to subside, and then by a powerful draught blowing outside into a room containing muslin bags, where it is deposited.

UNGUENTUM ZINCI OXIDI, U. S.—Zinc Oxide Ointment. (See Unguenta, Part II.)

OLEATUM ZINCI, U. S.—Oleate of Zinc.—Made by dissolving 50 Gm. of zinc oxide in 950 Gm. of oleic acid, by the aid of a gentle heat.

ZINCI PHOSPHIDUM, U. S.—Zinc Phosphide. Zn_3P_2; 257.22.—A gritty powder of dark gray color, or crystalline fragments of a dark metallic lustre. In contact with the air it slowly emits phosphorous vapor; faint odor and taste of phosphorus. Made by passing vapors of phosphorus over fused zinc in a current of dry hydrogen.

ZINCI SULPHAS, U. S.—Zinc Sulphate. $ZnSO_4.7H_2O$; 286.64.—Colorless, transparent rhombic crystals, efflorescing in dry air; odorless; astringent metallic taste; acid reaction. Made by acting on zinc with diluted sulphuric acid.

$$\underset{\textit{Zinc.}}{2Zn} + \underset{\substack{\text{Sulphuric}\\ \textit{Acid.}}}{2H_2SO_4} + \underset{\text{Water.}}{H_2O} = \underset{\substack{\text{Zinc}\\ \text{Sulphate.}}}{2ZnSO_4} + \underset{\text{Hydrogen.}}{4H} + \underset{\text{Water}}{H_2O.}$$

ZINCI VALERIANAS, U. S.—Zinc Valerianate. $Zn(C_5H_9O_2)_2.2H_2O$; 302.56—White, pearly scales, permanent in the air; odor of valerianic acid; sweet, afterward styptic and metallic taste; acid reaction. Made by double decomposition of zinc sulphate and sodium valerianate.

$$\underset{\substack{\text{Sodium}\\\text{Valerianate.}}}{2NaC_5H_9O_2} + \underset{\substack{\text{Zinc}\\\text{Sulphate.}}}{ZnSO_4} = \underset{\substack{\text{Zinc}\\\text{Valerianate.}}}{Zn(C_5H_9O_2)_2} + \underset{\substack{\text{Sodium}\\\text{Sulphate.}}}{Na_2SO_4}.$$

ALUMINUM. Al; 27.04.

ALUMEN, U. S.—Alum. (*Potassium Alum. Aluminum and Potassium Sulphate.*) $Al_2K_2(SO_4)_4.24H_2O$; 946.46.—Large, colorless, octahedral crystals, sometimes modified by cubes, or in crystalline fragments, which, on exposure to air, are liable to absorb ammonia and acquire a whitish coating; odorless; sweetish, strongly astringent taste; acid reaction. Made by treating alum-clay (chiefly aluminum silicate) with sulphuric acid and potassium sulphate.

ALUMEN EXSICCATUM, U. S.—Dried Alum. $Al_2K_2(SO_4)_4$; 515.42.—A white, granular powder, attracting moisture when exposed to the air; odorless; sweetish, astringent taste. Prepared by driving off the water of crystallization from alum.

ALUMINI HYDRAS, U. S.—Aluminum Hydrate. $Al_2(HO)_6$: 155.184. (*Aluminum Hydroxide. Hydrated Alumina.*)—A white, light, amorphous powder, permanent in dry air; odorless and tasteless. Made by double decomposition of alum and sodium carbonate.

$$\underset{\text{Potassium Alum.}}{Al_2K_2(SO_4)_4} + \underset{\substack{\text{Sodium}\\\text{Carbonate.}}}{3Na_2CO_3} + \underset{\text{Water.}}{3H_2O} =$$

$$\underset{\substack{\text{Aluminum}\\\text{Hydrate.}}}{Al_2(HO)_6} + \underset{\substack{\text{Potassium}\\\text{Sulphate.}}}{K_2SO_4} + \underset{\substack{\text{Sodium}\\\text{Sulphate.}}}{3Na_2SO_4} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{3CO_2}.$$

ALUMINI SULPHAS, U. S.—Aluminum Sulphate. $Al_2(SO_4)_3.16H_2O$; 628.9.—A white, crystalline powder, permanent in the air; odorless; sweetish, and afterward astringent taste; acid reaction. Made by treating aluminum hydrate with sulphuric acid, and crystallizing.

CERIUM. Ce; 139.9.

CERII OXALAS, U. S.—Cerium Oxalate. $Ce_2(C_2O_4)_3.9H_2O$; 704.78.—A white, granular powder, permanent in the air; odorless and tasteless. Made by decomposing the silicates in the powdered mineral containing the metal, with H_2SO_4.

The mass is then heated, and subsequently treated with HNO_3 and H_2S, to separate contaminating metals. Cerium chloride is now made by adding HCl, and this is precipitated by oxalic acid. This oxalate is then purified from lanthanum and didymium compounds by heating it with magnesium carbonate, to decompose the oxalates. The residue is now dissolved in HNO_3, and the solution added to water containing a little H_2SO_4. Ceric sulphate is produced, which is dissolved in H_2SO_4, and sodium sulphite added to reduce it to cerous sulphate. This is collected and treated with oxalic acid, when cerium oxalate precipitates.

The presence of the two rare metals, didymium and lanthanum, greatly complicates the preparation of this salt, as they can only be separated with difficulty.

CADMIUM. Cd; 111.5.

Cadmium enters into no official preparations, though it is used to some extent in medicine.

MANGANESE, IRON AND CHROMIUM.

MANGANESE. Mn; 54.8.

MANGANI DIOXIDUM, U. S.—Manganese Dioxide. (*Mangani Oxidum Nigrum, Pharm. 1880. Black Oxide of Manganese.*)—A heavy, grayish-black, more or less gritty powder, permanent in the air; odorless and tasteless; consisting of native crude Manganese Dioxide, containing at least 66 per cent. of the pure oxide (MnO_2; 86.72).

MANGANI SULPHAS, U. S.—Manganese Sulphate. $MnSO_4 \cdot 4H_2O$; 222.46.—Colorless, or pale rose-colored, transparent, tetragonal prisms; odorless; slightly bitter and astringent taste; neutral or faintly acid reaction. Made by Prof. Diehl's process. Manganese dioxide and charcoal are heated together to redness, the residue treated with sulphuric acid and again heated to redness, and the residue dissolved in water. The solution is then filtered and crystallized.

POTASSII PERMANGANAS, U. S.—Potassium Permanganate. (See Potassium.)

FERRUM, U. S.—IRON. Fe; 55.88.

Metallic iron, in the form of fine, bright, and non-elastic wire.

FERRUM REDUCTUM, U. S.—Reduced Iron.—A very fine, grayish-black, lustreless powder, permanent in dry air; without odor or taste. Made by passing hydrogen over subcarbonate of iron, heated in a reduction tube.

The subcarbonate directed in the U. S. P. process, is more properly an oxyhydrate, and the H combines with the O to form water, and metallic iron in fine powder is left behind.

$$\underset{\text{Ferric Oxide.}}{Fe_2O_3} + \underset{\text{Hydrogen.}}{6H} = \underset{\text{Iron.}}{2Fe} + \underset{\text{Water.}}{3H_2O.}$$

FERRI CARBONAS SACCHARATUS, U. S.—Saccharated Ferrous Carbonate. (*Saccharated Ferrous Carbonate.*)—A greenish-gray powder, gradually oxidized by contact with air; odorless; at first a sweetish, afterward a slightly ferruginous taste; neutral reaction. Made by double decomposition between ferrous sulphate and sodium bicarbonate. The precipitate is preserved with sugar.

$$\underset{\substack{\text{Ferrous}\\\text{Sulphate.}}}{FeSO_4} + \underset{\substack{\text{Sodium}\\\text{Bicarbonate.}}}{2NaHCO_3} = \underset{\substack{\text{Sodium}\\\text{Sulphate.}}}{Na_2SO_4} + \underset{\substack{\text{Ferrous}\\\text{Carbonate.}}}{FeCO_3} + \underset{\text{Water.}}{H_2O} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{CO_2.}$$

MASSA FERRI CARBONATIS, U. S.—Mass of Ferrous Carbonate. (*Vallet's Mass.*)—Prepared by double decomposition between ferrous sulphate and sodium carbonate. The precipitate is preserved with honey, which prevents the ferrous carbonate from oxidizing.

$$\underset{\text{Ferrous Sulphate.}}{FeSO_4} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Ferrous Carbonate.}}{FeCO_3} + \underset{\text{Sodium Sulphate.}}{Na_2SO_4}.$$

For Compound Iron Mixture and Pills of Ferrous Carbonate, see Part II.

FERRI CHLORIDUM, U. S.—Ferric Chloride. $Fe_2Cl_6.12H_2O$; 539.5.—Orange-yellow, crystalline pieces, very deliquescent in moist air; odorless, or having a faint odor of hydrochloric acid; strongly styptic taste; acid reaction. Made by acting on iron with hydrochloric acid, which converts it into ferrous chloride, $FeCl_2$, which is converted into ferric chloride (Fe_2Cl_6) by the addition of nitric and hydrochloric acids. The reaction is as follows:—

First Reaction.—

$$\underset{\text{Iron.}}{Fe} + \underset{\text{Hydrochloric Acid.}}{2HCl} = \underset{\text{Ferrous Chloride.}}{FeCl_2} + \underset{\text{Hydrogen.}}{H_2}.$$

Second Reaction.—Conversion of ferrous chloride into ferric chloride.

$$\underset{\text{Ferrous Chloride.}}{6FeCl_2} + \underset{\text{Hydrochloric Acid.}}{6HCl} + \underset{\text{Nitric Acid.}}{2HNO_3} = \underset{\text{Ferric Chloride.}}{3Fe_2Cl_6} + \underset{\text{Nitrogen Dioxide.}}{N_2O_2} + \underset{\text{Water.}}{4H_2O}.$$

LIQUOR FERRI CHLORIDI, U. S.—Solution of Ferric Chloride. (*Solution of Ferric Chloride.*)—A reddish-brown liquid, consisting of an aqueous solution (with some free hydrochloric acid) of ferric chloride (Fe_2Cl_6) containing 37.8 per cent. of the anhydrous salt, corresponding to 62.9 per cent. of the crystallized salt ($Fe_2Cl_6.12H_2O$; 539.5), or to about 13 per cent. of metallic iron. It has a faint odor of hydrochloric acid; acid, strongly styptic taste; acid reaction. Prepared by oxidizing solution of ferrous chloride with nitric acid.

TINCTURA FERRI CHLORIDI, U. S.—Tincture of Ferric Chloride. (See Tincturæ, Part II.)

FERRI CITRAS, U. S.—Ferric Citrate.—Thin, transparent, garnet-red scales, permanent in the air; odorless; very faint, ferruginous taste; acid reaction. Prepared by evaporating and scaling solution of ferric citrate.

FERRI ET AMMONII CITRAS, U. S.—Iron and Ammonnium Citrate. (*Ammonio-Ferric Citrate.*)—Thin, transparent, garnet-red scales, deliquescent on exposure to damp air; odorless; saline, mildly ferruginous taste; neutral reaction. Prepared by adding water of ammonia to solution of ferric citrate, evaporating and scaling.

LIQUOR FERRI CITRATIS, U. S.—Solution of Iron Citrate. (*Solution of Ferric Citrate.*)—A dark brown liquid; odorless; having a slightly ferruginous taste and an acid reaction; sp. gr. 1.250; consisting of an aqueous solution of ferric citrate, corresponding to about 7.5 per cent. of metallic iron. Prepared by dissolving ferric hydrate in citric acid.

The ferric hydrate is prepared by precipitating solution of tersulphate of iron with water of ammonia.

$$\underset{\text{Ferric Sulphate.}}{Fe_23SO_4} + \underset{\text{Hydrate Ammonium.}}{6NH_4HO} = \underset{\text{Ferric Hydrate.}}{Fe_2(HO)_6} + \underset{\text{Ammonium Sulphate.}}{3(NH_4)_2SO_4}.$$

VINUM FERRI CITRATIS, U. S.—Wine of Iron Citrate.— Generally known as Wine of Iron. (See Vina, Part II.)

FERRI ET QUININÆ CITRAS, U. S.—Iron and Quinine Citrate.—Transparent, thin scales, varying in color from reddish brown to yellowish brown, slowly deliquescent in damp air; odorless; bitter and mildly ferruginous taste; acid reaction. Made by dissolving quinine (alkaloid) in solution of ferric citrate, evaporating and scaling.

FERRI ET QUININÆ CITRAS SOLUBILIS, U. S.—Soluble Iron and Quinine Citrate.—Thin, transparent scales of a greenish, golden-yellow color, deliquescent in damp air; odorless; bitter, mildly ferruginous taste. Made by adding to a solution of citrate of iron, quinine and citric acid, previously dissolved in distilled water, then adding sufficient ammonia water to precipitate and redissolve, evaporating and scaling on plates of glass.

VINUM FERRI AMARUM, U. S.—Bitter Wine of Iron. (See Vina, Part II.)

FERRI ET STRYCHNINÆ CITRAS, U. S.—Iron and Strychnine Citrate.—Thin, transparent scales, varying in color from garnet-red to yellowish brown; deliquescent in damp air; odorless; bitter and slightly ferruginous taste; slightly acid reaction. Made by adding to a solution of citrate of iron and ammonium, citric acid and strychnine, and scaling.

SYRUPUS FERRI, QUININÆ ET STRYCHNINÆ PHOSPHATUM, U. S.—Syrup of Iron, Quinine, and Strychnine Phosphates.—Made by dissolving in an acid solution of ferric phosphate, quinine, strychnine, and sugar. (See Syrupi, Part II.) This preparation is also sometimes known as *Easton's Syrup.*

FERRI ET AMMONII SULPHAS, U. S.—Ferric Ammonium Sulphate. $Fe_2(NH_4)_2(SO_4)_4.24H_2O$; 962.1. (*Ammonio-Ferric Sulphate. Ammonio-Ferric Alum.*)—Pale-violet, octahedral crystals, efflorescent on exposure to air; odorless; acid, styptic taste; slightly acid reaction. Prepared by dissolving sulphate of ammonium in solution of tersulphate of iron, evaporating and crystallizing.

$$\underset{\text{Ferric Sulphate.}}{Fe_2 3SO_4} + \underset{\substack{\text{Ammonium}\\\text{Sulphate.}}}{(NH_4)_2SO_4} = \underset{\text{Ammonio-Ferric Sulphate.}}{Fe_2(NH_4)_2(SO_4)_4}.$$

FERRI ET AMMONII TARTRAS, U. S.—Iron and Ammonium Tartrate. (*Ammonio-Ferric Tartrate.*)—Thin, transparent scales, varying in color from garnet-red to yellowish brown, only slightly deliquescent; odorless; sweetish and slightly ferruginous taste; neutral reaction. Prepared by dissolving ferric hydrate in solution of acid ammonium tartrate, and scaling.

FERRI ET POTASSII TARTRAS, U. S.—Iron and Potassium Tartrate. (*Potassio-Ferric Tartrate.*)—Thin, transparent, slightly deliquescent scales; odorless; sweetish, slightly ferruginous taste; neutral reaction. Prepared by adding to ferric hydrate acid potassium tartrate and a trace of water of ammonia, and scaling.

"*Boule de Mars,*" an olive-shaped ball of Ferri et Potassii Tartras, devised by the French. When a mild chalybeate drink is required the ball is suspended in a glass of water until the necessary quantity is dissolved to constitute a dose.

FERRI HYPOPHOSPHIS, U. S.—Ferric Hypophosphite. $Fe_2(PH_2O_2)_6$; 501.04.—A white or grayish-white powder, permanent in the air; odorless; nearly tasteless. Made by double decomposition between calcium hypophosphite and ferrous sulphate. On evaporation, the resulting ferrous hypophosphite is changed to ferric hypophosphite. This is one of the hypophosphites recommended by Dr. Churchill in the treatment of phthisis:—

$$\underset{\substack{\text{Calcium}\\\text{Hypophosphite.}}}{Ca(H_2PO_2)_2} + \underset{\substack{\text{Ferrous}\\\text{Sulphate.}}}{FeSO_4} = \underset{\substack{\text{Calcium}\\\text{Sulphate.}}}{CaSO_4} + \underset{\substack{\text{Ferrous}\\\text{Hypophosphite.}}}{Fe(H_2PO_2)_2}.$$

FERRI IODIDUM SACCHARATUM, U. S.—Saccharated Ferrous Iodide.—A yellowish-white or grayish powder, very hygroscopic; odorless; sweetish, ferruginous taste; slightly acid reaction. Made by adding solution of ferrous iodide to sugar of milk.

SYRUPUS FERRI IODIDI, U. S.—Syrup of Ferrous Iodide.—Made by adding solution of ferrous iodide to sugar. A syrupy liquid, containing 10 per cent. of FeI_2. (See Syrupi, Part II.)

PILULÆ FERRI IODIDI, U. S.—Pills of Ferrous Iodide.—(See Pilulæ, Part II.)

FERRI LACTAS, U. S.—Ferrous Lactate.—$Fe(C_3H_5O_3)_2.3H_2O$; 287.34.—Pale greenish-white crusts, consisting of small, needle-shaped crystals, permanent in air; slight, peculiar odor; mild, sweetish, ferruginous taste; slightly acid reaction. Prepared by acting on iron with lactic acid, and crystallizing the solution:—

$$\underset{\text{Iron.}}{Fe_2} + \underset{\text{Lactic Acid.}}{4HC_3H_5O_3} = \underset{\text{Ferrous Lactate.}}{2Fe(C_3H_5O_3)_2} + \underset{\text{Hydrogen.}}{H_4}.$$

FERRI OXIDUM HYDRATUM, U. S.—Ferric Hydrate. $Fe_2(HO)_6$; 213.52.—Frequently used as an antidote for arsenic, and prepared by adding water of ammonia to solution of tersulphate of iron, collecting and washing the precipitate. The reaction is as follows:—

$$\underset{\substack{\text{Ferric}\\\text{Sulphate.}}}{Fe_23SO_4} + \underset{\substack{\text{Ammonium}\\\text{Hydrate.}}}{6NH_4HO} = \underset{\substack{\text{Ferric}\\\text{Hydrate.}}}{Fe_2(HO)_6} + \underset{\substack{\text{Ammonium}\\\text{Sulphate.}}}{3(NH_4)_2SO_4}.$$

The reaction occurs when it is used as an antidote as follows:—

$$\underset{\substack{\text{Ferric}\\\text{Hydrate.}}}{2Fe_2(HO)_6} + \underset{\substack{\text{Arsenious}\\\text{Oxide.}}}{As_2O_3} = \underset{\substack{\text{Ferrous}\\\text{Arsenate.}}}{Fe_3(AsO_4)_2} + \underset{\substack{\text{Ferrous}\\\text{Hydrate.}}}{Fe(HO)_2} + \underset{\text{Water.}}{5H_2O}.$$

Hydrated oxide of iron should not be retained for any length of time on hand, because it decomposes even when kept under water. The ingredients, however, should always be ready for immediate use, weighed out in suitable bottles, and kept in an accessible and well-known place, ready for instant use in case of emergency.

FERRI OXIDUM HYDRATUM CUM MAGNESIA, U. S.—Ferric Hydrate with Magnesia. (*Arsenic Antidote.*)—Solution of Ferric Sulphate 50 C.c. (1 fl.oz. 5½ fl.dr.); Magnesia 10 Gm. (154 grains); Water, a sufficient quantity. Mix the solution of ferric sulphate with

100 C.c. (old form 3 fl.oz.) of water, and keep the liquid in a large, well stoppered bottle. Rub the magnesia with cold water to a smooth and thin mixture, transfer this to a bottle capable of holding about 1000 C.c. (old form 2 pints), and fill it with water to about three-fourths of its capacity. When the preparation is wanted for use shake the magnesia mixture to a homogeneous, thin magma, add it gradually to the iron solution, and shake them together until a uniform, smooth mixture results.

This preparation is to be preferred to the above as an antidote for arsenic, as it is not necessary to wash the precipitate, and the reaction that occurs leaves in solution sulphate of magnesium, which acts as a cathartic and carries off the ferrous arsenate formed.

FERRI PHOSPHAS SOLUBILIS, U. S.—Soluble Ferric Phosphate.—Thin, bright green, transparent scales, permanent in dry air when excluded from light, but turning dark on exposure to light; odorless; acidulous, slightly saline taste; slightly acid reaction. Prepared by mixing solution of citrate of iron and phosphate of sodium, evaporating in scales.

This is not a definite chemical compound, but is sometimes termed sodio-ferric citro-phosphate, and greatly resembles the official ferric pyrophosphate. It is a scaled salt, and quite different from the insoluble slate-colored powder of phosphate of iron, formerly official.

FERRI PYROPHOSPHAS SOLUBILIS, U. S.—Soluble Ferric Pyrophosphate.—Thin, apple-green, transparent scales, permanent in dry air when excluded from light, but turning dark on exposure to light; odorless; acidulous, slightly saline taste; slightly acid reaction. Made by mixing solutions of citrate of iron and pyrophosphate of sodium, evaporating in scales.

The compound is a mixture of several salts, and not a definite chemical compound. It consists of sodio-ferric pyrophosphate, sodio-ferric citrate, and ferric sulphate. It differs from the salt formerly official, which was an insoluble ferric phosphate $Fe_43P_2O_7$, dissolved in solution of ammonium citrate. It also differs from that insoluble gelatinous precipitate, sometimes formed when tincture of chloride of iron is added to dilute phosphoric acid. This is also a pyrophosphate of iron.

FERRI SULPHAS, U. S.—Ferrous Sulphate. $FeSO_4.7H_2O$; 277.42.—Large, pale bluish-green, monoclinic prisms, efflorescent, and absorbing oxygen rapidly on exposure to air; odorless; saline, styptic taste; acid reaction. Made by treating iron with diluted sulphuric acid, evaporating and crystallizing:—

$$\begin{array}{ccccccc} Fe_2 & + & 2H_2SO_4 & = & 2FeSO_4 & + & 4H. \\ \text{Iron.} & & \text{Sulphuric Acid.} & & \text{Ferrous Sulphate.} & & \text{Hydrogen.} \end{array}$$

FERRI SULPHAS EXSICCATUS, U. S.—Dried Ferrous Sulphate. Approximately $2FeSO_4.3H_2O$; 357.28.—A grayish-white powder prepared by exsiccating 100 Gm. of ferrous sulphate at a temperature about 40° C. (104° F.), and still containing about 15 per cent. water of crystallization; and then heating on water-bath, constantly stirring, *until the* product weighs from 64 to 65 Gm. Powder, and bottle tightly. *Three grains represent* about five grains of the crystals.

FERRI SULPHAS GRANULATUS, U. S.—Granulated Ferrous Sulphate. (*Ferri Sulphas Præcipitatus*, Pharm. 1880.) $FeSO_4.7H_2O$; 277.42.—A very pale bluish-green, crystalline powder, efflorescent in dry air, but when in contact with moisture, becoming gradually oxidized; odorless; saline, styptic taste; acid reaction. Made by precipitating an aqueous solution of ferrous sulphate with alcohol.

FERRI VALERIANAS, U. S.—Ferric Valerianate. A dark brick-red, amorphous powder of somewhat varying chemical composition, permanent in dry air; faint odor of valerian; acid, mildly styptic taste. Prepared by double decomposition, between ferric sulphate and sodium valerianate.

LIQUOR FERRI ACETATIS, U. S.—Solution of Ferric Acetate.—A dark reddish-brown, transparent liquid; acetous odor; sweetish, faintly styptic taste; slightly acid reaction. An aqueous solution of ferric acetate ($Fe_2(C_2H_3O_2)_6$; 464.92). Containing 31 per cent. of the anhydrous salt, and corresponding to about 7.5 per cent. of metallic iron. Sp. gr. about 1.160 at 15° C. (59° F.). Prepared by dissolving ferric hydrate in glacial acetic acid.

LIQUOR FERRI ET AMMONII ACETATIS, U. S.—Solution of Acetate of Iron and Ammonium. (See Liquores, Part II.)

LIQUOR FERRI NITRATIS, U. S.—Solution of Ferric Nitrate.—A transparent, amber colored, or reddish liquid, without odor, having an acid, strongly styptic taste, and an acid reaction; specific gravity 1.050. An aqueous solution of Ferric Nitrate ($Fe_2(NO_3)_6$; 483.1), containing about 6.2 per cent. of the anhydrous salt, and corresponding to about 1.4 per cent. of metallic iron. Made by dissolving ferric hydrate in dilute nitric acid.

LIQUOR FERRI SUBSULPHATIS, U. S.—Solution of Ferric Subsulphate. (*Solution of Basic Ferric Sulphate. Monsel's Solution.*) —An aqueous solution of Basic Ferric Sulphate (of variable chemical composition, corresponding to about 13.6 per cent. of metallic iron. It is a dark reddish-brown liquid; sp. gr. 1.550; odorless, or nearly so; extremely astringent taste; acid reaction. Made by heating ferrous sulphate in a mixture of sulphuric and nitric acid. An aqueous solution, containing 43.7 per cent. of $Fe_4O(SO_4)_5$.

LIQUOR FERRI TERSULPHATIS, U. S.—Solution of Ferric Sulphate.—An aqueous solution of normal Ferric Sulphate ($Fe_2(SO_4)_3$; 399.22), containing about 28.7 per cent. of the salt, and corresponding to about 8 per cent. of metallic iron. It is a dark reddish-brown liquid; sp. gr. about 1.320 at 15° C. (59° F.); almost odorless; acid, strongly styptic taste; acid reaction. Made by heating ferrous sulphate in a mixture of nitric acid with excess of sulphuric acid.

This solution differs from the solution of subsulphate of iron, merely in containing a larger proportion of sulphuric acid. It has the sp. gr. of 1.320, and is a solution of the *true* persulphate $Fe_2(SO_4)_3$, or normal ferric sulphate. Solution of persulphate of iron is the name under which Monsel's Solution is erroneously prescribed. The latter is a solution of a subsalt, $Fe_4O(SO_4)_5$. The reaction is as follows:—

$$\underset{\substack{\text{Ferrous}\\\text{Sulphate.}}}{6FeSO_4} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{3H_2SO_4} + \underset{\substack{\text{Nitric}\\\text{Acid.}}}{2HNO_3} = \underset{\substack{\text{Ferric}\\\text{Sulphate.}}}{3(Fe_23SO_4)} + \underset{\substack{\text{Nitrogen}\\\text{Monoxide.}}}{NO} + \underset{\text{Water.}}{4H_2O}.$$

CHROMIUM. Cr; 52.

ACIDUM CHROMICUM, U. S.—Chromic Acid. CrO_3; 99.88 —Small, dark purplish-red, needle-shaped, or rhombic crystals of a metallic lustre; deliquescent in moist air, destructive to animal and vegetable tissues; odorless. Made by decomposing potassium bichromate with sulphuric acid. Chromic acid is more properly called *chromic anhydride*:—

$$\underset{\substack{\text{Potassium}\\\text{Bichromate.}}}{K_2Cr_2O_7} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{2H_2SO_4} = \underset{\substack{\text{Chromic}\\\text{Acid.}}}{2CrO_3} + \underset{\substack{\text{Potassium}\\\text{Acid Sulphate.}}}{2KHSO_4} + \underset{\text{Water.}}{H_2O.}$$

NICKEL, COBALT, AND TIN.

Ni; 58. Co; 58.6. Sn; 118.8.

There are no official preparations of these metals. Nickel has recently come into use in the form of bromide, chloride, etc., and seems to be of considerable merit. None of the unofficial salts of cobalt are of pharmaceutical interest. Tin is of no interest pharmaceutically, but its salts are of great importance in the arts.

LEAD, COPPER, SILVER, AND MERCURY.

Pb; 206.4. Cu; 63.18. Ag; 107.66. Hg; 199.8.

LEAD. Pb (Plumbum); 206.4.

Lead is obtained by roasting the native sulphide, *Galena*. It is a heavy, soft, bluish metal, with a sp. gr. of 11.45.

Lead and its compounds are poisonous; and as this metal is used to a large extent in the manufacture of water-pipes, the effect of water on lead is of interest. Pure water is a solvent of lead to a certain extent, owing to the formation of a slightly soluble hydroxide or carbonate. The purer the water the more dangerous it is in this way. If traces of sulphates or chlorides be present in the water, however, an insoluble coating is formed on the surface of the metal, which protects it from further decomposition.

PLUMBI ACETAS, U. S.—Lead Acetate. $Pb(C_2H_3O_2)_2.3H_2O$; 378.0. (*Sugar of Lead.*)—Colorless, shining, transparent, monoclinic prisms or plates, or heavy, white, crystalline masses, or in granular crystals, efflorescent and attracting carbon dioxide on exposure to air; faintly acetous odor; sweetish, astringent, afterward metallic taste; faintly acid reaction. Made by treating lead oxide with acetic acid, evaporating and crystallizing:—

$$\underset{\text{Lead Oxide.}}{PbO} + \underset{\text{Acetic Acid.}}{2HC_2H_3O_2} = \underset{\text{Lead Acetate.}}{Pb(C_3H_3O_2)_2} + \underset{\text{Water.}}{H_2O.}$$

The commercial salt is unfit for use, because it usually contains carbonate and oxide of lead.

LIQUOR PLUMBI SUBACETATIS, U. S.—Solution of Lead Subacetate. (*Goulard's Extract.*)—An aqueous liquid, containing in solution about 25 per cent. of Lead Subacetate (approximately $Pb_2O(C_2H_3O_2)_2$; 546.48). It is a clear, colorless liquid; odorless; of a sweetish, astringent taste and an alkaline reaction; sp. gr. 1.195. Made by boiling solution of lead acetate with lead oxide.

The subacetate is not a definite salt, but as found in official solutions, it is a mixture of oxyacetates, produced by boiling the normal acetate in water in contact with the oxide. The following reaction occurs :—

$$\underset{\text{Lead Oxide.}}{3PbO} + \underset{\text{Lead Acetate.}}{3(Pb2C_2H_3O_2)} =$$

$$\underbrace{Pb_3O(C_2H_3O_2)_4 + Pb_3O_2(C_2H_3O_2)_2}_{\text{Lead Oxyacetates.}}.$$

LIQUOR PLUMBI SUBACETATIS DILUTUS, U. S.— Diluted Solution of Lead Subacetate. (*Lead-Water.*)—Made by diluting 30 C.c. of solution of subacetate of lead with 970 C.c. of water.

The opalescence of lead-water is due to the formation of a trace of carbonate if the distilled water used has not been recently freed from carbonic acid gas by boiling and cooling it. A few drops of acetic acid will clear it, however; but it should be dispensed opalescent, to distinguish it from lime-water, for which it has often been mistaken, with serious results.

CERATUM PLUMBI SUBACETATIS, U. S.—Cerate of Lead Subacetate. (*Goulard's Cerate.*)—20 Gm. Goulard's Extract; 80 Gm. Camphor Cerate. (See Cerata, Part II.)

PLUMBI CARBONAS, U. S. — Lead Carbonate. — $(PbCO_3)_2.Pb(HO)_2$; 772.82 (*White Lead*).—A heavy, white, opaque powder or pulverulent mass, permanent in the air; odorless and tasteless. Made by acting on metallic lead with fumes of acetic acid and decaying matter.

Plumbi carbonas is a mixture of carbonate and hydrate.

UNGUENTUM PLUMBI CARBONATIS, U. S.—Ointment of Lead Carbonate.—Lead Carbonate, 10 Gm.; Benzoated Lard, 90 Gm. (See Unguenta, Part II.)

PLUMBI IODIDUM, U. S.—Lead Iodide. PbI_2; 459.46.— A heavy, bright yellow powder, permanent in the air; odorless; tasteless; neutral reaction. Made by double decomposition between lead nitrate and potassium iodide :—

$$\underset{\text{Potassium Iodide.}}{2KI} + \underset{\text{Lead Nitrate.}}{Pb2NO_3} = \underset{\text{Lead Iodide.}}{PbI_2} + \underset{\text{Potassium Nitrate.}}{2KNO_3}.$$

UNGUENTUM PLUMBI IODIDI, U. S.—Ointment of Lead Iodide.—Lead Iodide, 10 Gm.; Benzoated Lard, 90 Gm. (See Unguenta, Part II.)

PLUMBI NITRAS, U. S.—Lead Nitrate. $Pb(NO_3)_2$; 330.18. —Colorless, transparent, octahedral crystals, when obtained by the spontaneous evaporation of cold solutions, or white, nearly opaque crystals, when formed by the cooling of hot solutions; permanent in the air; odorless; sweetish, astringent, afterward metallic, taste; acid reaction. Made by treating lead oxide with diluted nitric acid, evaporating and crystallizing,

PLUMBI OXIDUM, U. S.—Lead Oxide. PbO; 222.36. (*Litharge.*) —A heavy, yellowish or reddish-yellow powder or minute scales, permanent in the air; odorless; tasteless. Made by roasting lead ore.

Red Lead is a higher oxide. Pb_3O_4. Made by sprinkling hot litharge (PbO) with water, powdering, drying and heating out of contact with air.

EMPLASTRUM PLUMBI, U. S.—Lead Plaster.—Made by boiling lead with olive oil and water. The lead combines with the fatty acids of the oil and forms an oleo-palmitate of lead, setting free glyceryl, which unites with the water present to form hydrate of glyceryl, or glycerin. (See Emplastra, Part II.)

UNGUENTUM DIACHYLON, U. S.—Diachylon Ointment.—Made by diluting lead plaster with olive oil and perfuming with oil of lavender. (See Unguenta, Part II.)

COPPER. Cu; 63.18.

CUPRI SULPHAS, U. S.—Copper Sulphate. (*Cupric Sulphate.*) $CuSO_4.5H_2O$; 248.8—Large, translucent, deep-blue, triclinic crystals; efflorescent in dry air; odorless; nauseous, metallic taste; acid reaction. Commonly called *blue vitriol.* Made by treating copper with diluted sulphuric acid, evaporating the solution, and crystallizing.

SILVER. Ag; 107.66.

A brilliant, white metal, very malleable and ductile, having a specific gravity of 10.4 to 10.5.

ARGENTI CYANIDUM, U. S.—Silver Cyanide. AgCN; 133.64.—A white powder, permanent in dry air, but gradually turning brown by exposure to light; odorless and tasteless. Made by passing hydrocyanic gas into solution of silver nitrate, or by mixing solutions of silver nitrate with potassium cyanide:—

$$\underset{\substack{\text{Silver}\\\text{Nitrate.}}}{AgNO_3} + \underset{\substack{\text{Potassium}\\\text{Cyanide.}}}{KCN} = \underset{\substack{\text{Silver}\\\text{Cyanide.}}}{AgCN} + \underset{\substack{\text{Potassium}\\\text{Nitrate.}}}{KNO_3}.$$

ARGENTI IODIDUM, U. S.—Silver Iodide. AgI; 234.19.—A heavy, amorphous, light-yellowish powder, unaltered by light if pure, but generally becoming greenish-yellow; odorless and tasteless. Made by double decomposition between potassium iodide and silver nitrate:—

$$\underset{\substack{\text{Potassium}\\\text{Iodide.}}}{KI} + \underset{\substack{\text{Silver}\\\text{Nitrate.}}}{AgNO_3} = \underset{\substack{\text{Silver}\\\text{Iodide.}}}{AgI} + \underset{\substack{\text{Potassium}\\\text{Nitrate.}}}{KNO_3}.$$

ARGENTI NITRAS, U. S.—Silver Nitrate. $AgNO_3$; 169.55.—Colorless, transparent, tabular, rhombic crystals, becoming gray or grayish-black on exposure to light in the presence of organic matter; odorless; bitter, caustic, and strongly metallic taste; neutral reaction. Made by treating metallic silver with nitric acid, evaporating and crystallizing:—

$$\underset{\text{Silver.}}{Ag_3} + \underset{\text{Nitric Acid.}}{4HNO_3} = \underset{\text{Silver Nitrate.}}{3AgNO_3} + \underset{\substack{\text{Nitrogen}\\\text{Monoxide.}}}{NO} + \underset{\text{Water.}}{2H_2O}.$$

ARGENTI NITRAS DILUTUS, U. S.—Diluted Silver Nitrate. (*Mitigated Caustic*).—A white, hard solid, generally in form of pencils or cones of a finely granular fracture, becoming gray, or grayish-black on exposure to light in presence of organic matter. Odorless, having a caustic, metallic taste and a neutral reaction. Made by melting together one part of nitrate of silver and two of nitrate of potassium, and moulding.

ARGENTI NITRAS FUSUS, U. S.—Moulded Silver Nitrate, (*Lunar Caustic.*)—Made by fusing and moulding silver nitrate in the form of points or cones. The description applied to mitigated caustic answers for the fused nitrate except the fracture of the latter is fibrous instead of granular. The official process calls for a small portion of HCl, which is added to give greater toughness to the pencils.

ARGENTI OXIDUM, U. S.—Silver Oxide. Ag_2O; 231.28.—A heavy, dark brownish-black powder, liable to reduction by exposure to light; odorless; metallic taste; imparting alkaline reaction to water. Made by precipitating solution of silver nitrate with solution of potassium hydrate:—

$$\underset{\text{Silver Nitrate.}}{2AgNO_3} + \underset{\text{Potassium Hydrate.}}{2KHO} = \underset{\text{Silver Oxide.}}{Ag_2O} + \underset{\text{Potassium Nitrate.}}{2KNO_3} + \underset{\text{Water.}}{H_2O.}$$

MERCURY. Hg; 199.8.

HYDRARGYRUM, U. S.—Mercury. Hg; 199.8. (*Quicksilver.*)—A shining, silver-white metal, liquid at temperatures above —40° C. (—40° F.); odorless and tasteless.

Mercury may be purified from mechanical impurities by squeezing it through chamois, or by distillation with HCl, after which the HCl is washed out with distilled water, and the mercury dried by the aid of filtering paper and a water bath.

HYDRARGYRUM CUM CRETA, U. S.—Mercury with Chalk.—A light gray powder, free from grittiness. Made by extinguishing 38 Gm. Hg with 10 Gm. clarified honey and 57 Gm. prepared chalk.

EMPLASTRUM HYDRARGYRI, U. S.—Mercurial Plaster.—Made by extinguishing 300 Gm. Hg, with 12 Gm. oleate of mercury, and incorporating with 688 Gm. melted lead plaster. (See Emplastra, Part II.)

EMPLASTRUM AMMONIACI CUM HYDRARGYRO, U. S.—Ammoniac Plaster with Mercury.—Made by extinguishing 18 per cent. of Hg with ammonia, olive oil, sublimated sulphur, diluted acetic acid and lead plaster. (See Emplastra, Part II.)

MASSA HYDRARGYRI, U. S.—Mass of Mercury. (*Pilulæ Hydrargyri. Blue Mass. Blue Pill.*)—Made by extinguishing 33 Gm. Hg with honey of rose and glycerin, adding powdered glycyrrhiza and powdered althæa. (See Massæ, Part II.)

UNGUENTUM HYDRARGYRI, U. S.—Mercurial Ointment.—Made by extinguishing 500 Gm. Hg with 20 Gm. oleate of mercury and then adding 250 Gm. lard and 230 Gm. suet, melted together. (See Unguenta, Part II.)

HYDRARGYRUM AMMONIATUM, U. S.—Ammoniated Mercury. NH_2HgCl; 251.1. (*White Precipitate. Mercuric Ammonium Chloride.*)—White, pulverulent pieces, or a white, amorphous powder, permanent in the air; odorless and tasteless. Made by precipitating solution of mercuric chloride with water of ammonia:—

$$\underset{\text{Mercuric Chloride.}}{HgCl_2} + \underset{\text{Water of Ammonia.}}{2NH_4HO} = \underset{\text{Ammonium Chloride.}}{NH_4Cl} + \underset{\text{Mercurammonium Chloride.}}{NH_2HgCl} + \underset{\text{Water.}}{2H_2O.}$$

UNGUENTUM HYDRARGYRI AMMONIATI, U. S.—Ointment of Ammoniated Mercury.—Ammoniated mercury, 10 Gm.; benzoated lard, 90 Gm.

HYDRARGYRI CHLORIDUM CORROSIVUM, U. S.—Corrosive Mercuric Chloride.—$HgCl_2$; 270.5. (*Corrosive Sublimate. Mercuric Chloride.*)—Heavy, colorless, rhombic crystals, or crystalline masses, permanent in the air; odorless; acrid and persistent metallic taste; acid reaction. Made by subliming mercuric sulphate with sodium chloride.

The mercuric sulphate is formed by boiling Hg with H_2SO_4:—

$$\underset{\text{Sulphuric Acid.}}{2H_2SO_4} + \underset{\text{Mercury.}}{Hg} = \underset{\text{Mercuric Sulphate.}}{HgSO_4} + \underset{\text{Sulphurous Acid.}}{SO_2} + \underset{\text{Water.}}{2H_2O.}$$

This is mixed with NaCl and sublimed. The following reaction occurs. Sodium sulphate remains behind:—

$$\underset{\text{Mercuric Sulphate.}}{HgSO_4} + \underset{\text{Sodium Chloride.}}{(NaCl)_2} = \underset{\text{Sodium Sulphate.}}{Na_2SO_4} + \underset{\text{Mercuric Chloride.}}{HgCl_2.}$$

HYDRARGYRI CHLORIDUM MITE, U. S.—Mild Mercurous Chloride. Hg_2Cl_2; 470.34. (*Calomel. Mercurous Chloride.*)—A white, impalpable powder, permanent in the air; odorless and tasteless. Prepared by subliming mercuric sulphate and mercury with sodium chloride.

In preparing calomel, mercuric sulphate is formed in the same manner as in the preparation of corrosive sublimate; this is then triturated with a quantity of mercury equal to that used in forming it, thus producing mercurous sulphate, which is then sublimed with sodium chloride. Sodium sulphate remains behind:—

$$\underset{\text{Sulphuric Acid.}}{2H_2SO_4} + \underset{\text{Mercury.}}{Hg} = \underset{\text{Mercuric Sulphate.}}{HgSO_4} + \underset{\text{Sulphurous Acid.}}{SO_2} + \underset{\text{Water.}}{2H_2O.}$$

$$\underset{\text{Mercuric Sulphate.}}{HgSO_4} + \underset{\text{Mercury.}}{Hg} = \underset{\text{Mercurous Sulphate.}}{Hg_2SO_4.}$$

$$\underset{\text{Mercurous Sulphate.}}{Hg_2SO_4} + \underset{\text{Sodium Chloride.}}{2NaCl} = \underset{\text{Mercurous Chloride.}}{Hg_2Cl_2} + \underset{\text{Sodium Sulphate.}}{Na_2SO_4.}$$

HYDRARGYRI CYANIDUM, U. S.—Mercuric Cyanide. $Hg(CN)_2$; 251.7.—Colorless, or white, prismatic crystals, becoming colored on exposure to light; odorless; bitter, metallic taste; neutral reaction. Made by passing hydrocyanic acid into a vessel containing mercuric oxide, with water:—

$$\underset{\text{Hydrocyanic Acid.}}{(HCN)_2} + \underset{\text{Mercuric Oxide.}}{HgO} = \underset{\text{Mercuric Cyanide.}}{Hg(CN)_2} + \underset{\text{Water.}}{H_2O.}$$

HYDRARGYRI IODIDUM RUBRUM, U. S.—Red Mercuric Iodide. HgI_2; 452.86. (*Biniodide of Mercury. Red Iodide of Mercury.*)—A scarlet-red, amorphous powder, permanent in the air; odorless and tasteless. Made by double decomposition between mercuric chloride and potassium iodide:—

$$\underset{\text{Mercuric Chloride.}}{HgCl_2} + \underset{\text{Potassium Iodide.}}{2KI} = \underset{\text{Mercuric Iodide.}}{HgI_2} + \underset{\text{Potassium Chloride.}}{2KCl.}$$

HYDRARGYRI IODIDUM FLAVUM, U. S.—Yellow Mercurous Iodide. Hg_2I_2; 652.66. (*Hydrargyri Iodidum Viride, Pharm. 1880. Protiodide of Mercury. Yellow (or Green) Iodide of Mercury.*)—Bright yellow, amorphous powder. Odorless and tasteless. By exposure to the light it becomes darker, in proportion as it undergoes decomposition into metallic mercury and mercuric iodide. Made by rubbing together mercury and iodine and adding alcohol. Alcohol is added to keep down the temperature by its evaporation, and as some HgI_2 is formed, and is soluble in alcohol, it may be washed out thereby.

HYDRARGYRI OXIDUM FLAVUM, U. S.—Yellow Mercuric Oxide. HgO; 215.76.—A light orange-yellow, heavy, impalpable powder, permanent in the air and turning darker on exposure to light:—

$$\underset{\substack{\text{Mercuric}\\ \text{Chloride.}}}{HgCl_2} + \underset{\substack{\text{Potassium}\\ \text{Hydrate.}}}{2KHO} = \underset{\substack{\text{Mercuric}\\ \text{Oxide.}}}{HgO} + \underset{\substack{\text{Potassium}\\ \text{Chloride}}}{2KCl} + \underset{\text{Water.}}{H_2O.}$$

This oxide, when digested on a water-bath for fifteen minutes, with a strong solution of oxalic acid, forms mercuric oxalate of a white color, distinguishing it from red oxide.

UNGUENTUM HYDRARGYRI OXIDI FLAVI, U. S.—Ointment of Yellow Mercuric Oxide.—Oxide, 10 Gm.; ointment, 90 Gm.

OLEATUM HYDRARGYRI, U. S.—Oleate of Mercury.—Made by dissolving 20 Gm. yellow oxide in 80 Gm. oleic acid.

HYDRARGYRI OXIDUM RUBRUM, U. S.—Red Mercuric Oxide. HgO; 215.76. (*Red Precipitate.*)—Heavy, orange-red, crystalline scales, or a crystalline powder, becoming more yellow the finer it is divided, permanent in the air; odorless, with somewhat metallic taste. Made by decomposing mercuric nitrate by heat:—

$$\underset{\substack{\text{Mercuric}\\ \text{Nitrate.}}}{Hg(NO_3)_2} + \text{heat} = \underset{\substack{\text{Mercuric}\\ \text{Oxide.}}}{HgO} + \underset{\substack{\text{Nitrogen}\\ \text{Dioxide.}}}{2NO_2} + \underset{\text{Oxygen.}}{O.}$$

UNGUENTUM HYDRARGYRI OXIDI RUBRI, U. S.—Ointment of Red Mercuric Oxide.—Red oxide, 10 Gm.; 5 Gm. castor oil; mercury ointment, 85 Gm.

HYDRARGYRI SUBSULPHAS FLAVUS, U. S.—Yellow Mercuric Subsulphate. $Hg(HgO)_2SO_4$; 727.14. (*Basic Mercuric Sulphate. Turpeth Mineral.*)—A heavy, lemon-yellow powder, permanent in the air; odorless and almost tasteless. Made by adding mercuric sulphate to boiling water. Acid mercuric sulphate remains in solution.

LIQUOR HYDRARGYRI NITRATIS, U. S.—Solution of Mercuric Nitrate.—A clear, nearly colorless, heavy liquid; sp. gr. 2.100; faint odor of nitric acid; strongly acid reaction. Made by dissolving 40 Gm. red oxide with 45 Gm. nitric acid and 15 Gm. water. Contains about 60 per cent. of mercuric nitrate $Hg(NO_3)_2$ with some free nitric acid.

UNGUENTUM HYDRARGYRI NITRATIS, U. S.—Ointment of Mercuric Nitrate. (*Citrine Ointment.*)—Made by treating lard oil with nitric acid, and then incorporating solution of mercuric nitrate. The olein is converted into elaidin, and the color changes to a deep orange, by the action of nitric acid on the lard oil.

ANTIMONY, ARSENIC AND BISMUTH.

Sb; 119.6. As; 74.9. Bi; 208.9.

ANTIMONY (STIBIUM). Sb; 119.6.

ANTIMONII ET POTASSII TARTRAS, U. S.—Antimony and Potassium Tartrate. $2K(SbO)C_4H_4O_6.H_2O$; 662.42. (*Tartar Emetic. Tartarated Antimony.*)—Small, transparent crystals of the rhombic system, becoming opaque and white on exposure to air, or a white, granular powder; sweet, afterward disagreeable metallic taste; feebly acid reaction. Made by boiling antimonous oxide and acid potassium tartrate together with water, evaporating and crystallizing:—

$$\underset{\text{Acid Potassium Tartrate.}}{2KHC_4H_4O_6} + \underset{\text{Antimonous Oxide.}}{Sb_2O_3} = \underset{\text{Antimony Potassium Tartrate.}}{2KSbOC_4H_4O_6} + \underset{\text{Water.}}{H_2O.}$$

ANTIMONII OXIDUM, U. S.—Antimony Oxide. Sb_2O_3; 287.08. (*Antimony Trioxide.*)—A heavy, grayish-white powder, permanent in the air; odorless and tasteless. Made by adding antimonous chloride to water, and treating the oxychloride formed with water of ammonia.

The process consists of three steps, as follows:—

The first step is the formation of antimonous chloride, $SbCl_3$, with the following reaction:—

$$\underset{\text{Antimony Sulphide.}}{Sb_2S_3} + \underset{\text{Hydrochloric Acid.}}{6HCl} = \underset{\text{Antimonous Chloride.}}{2SbCl_3} + \underset{\text{Hydrosulphuric Acid.}}{3H_2S.}$$

The second step consists of adding the antimonous chloride to water, oxychloride being formed:—

$$\underset{\text{Antimonous Chloride.}}{12SbCl_3} + \underset{\text{Water.}}{15H_2O} = \underset{\text{Antimony Oxychloride.}}{2SbCl_35Sb_2O_3} + \underset{\text{Hydrochloric Acid.}}{30HCl.}$$

The third step consists in converting the oxychloride into oxide, by treating it with ammonia:—

$$\underset{\text{Antimony Oxychloride.}}{2SbCl_3,5Sb_2O_3} + \underset{\text{Ammonia.}}{6NH_3} + \underset{\text{Water.}}{3H_2O} = \underset{\text{Antimony Oxide.}}{6Sb_2O_3} + \underset{\text{Ammonium Chloride.}}{6NH_4Cl.}$$

ANTIMONII SULPHIDUM, U. S.—Antimony Sulphide, Sb_2S_3; 335.14. (*Antimony Trisulphide.*)—Native sulphide of antimony, purified by fusion, and as nearly free from arsenic as possible. Steel-gray masses, of a metallic lustre, and a striated, crystalline fracture, forming a black or grayish-black, lustreless powder; odorless and tasteless.

ANTIMONII SULPHIDUM PURIFICATUM, U. S.—Purified Antimony Sulphide. Sb_2S_3; 335.14.—A dark-gray powder; odorless and tasteless. Prepared by macerating antimonous sulphide. with water containing a trace of water of ammonia.

ANTIMONIUM SULPHURATUM, U. S.—Sulphurated *Antimony*. (*Kermes Mineral.*)—Chiefly antimony trisulphide (Sb_2S_3;

335.14) with a very small amount of antimony trioxide. A reddish-brown, amorphous powder; odorless and tasteless. Made by boiling antimonous sulphide with solution of soda, and adding sulphuric acid to the hot solution.

This process consists of two steps. *First*, the formation of sodium antimonite by the action of sodium hydrate on antimonous sulphide:—

$$\underset{\text{Antimonous Sulphide.}}{Sb_2S_3} + \underset{\text{Sodium Hydrate.}}{6NaHO} = \underset{\text{Sodium Antimonite.}}{Na_3SbO_3} + \underset{\text{Sodium Sulph-Antimonite.}}{Na_3SbS_3} + \underset{\text{Water.}}{3H_2O}.$$

Second, decomposition of sodium antimonite and sodium sulph-antimonite by sulphuric acid:—

$$\underset{\text{Sodium Antimonite.}}{2Na_3SbO_3} + \underset{\text{Sulphuric Acid.}}{3H_2SO_4} = \underset{\text{Sodium Sulphate.}}{3Na_2SO_4} + \underset{\text{Antimonous Oxide.}}{Sb_2O_3} + \underset{\text{Water.}}{3H_2O}.$$

And—

$$\underset{\text{Sodium Sulph-antimonite.}}{2Na_3SbS_3} + \underset{\text{Sulphuric Acid.}}{3H_2SO_4} = \underset{\text{Sodium Sulphate.}}{3Na_2SO_4} + \underset{\text{Antimonous Sulphide.}}{Sb_2S_3} + \underset{\text{Hydrosulphuric Acid.}}{3H_2S}.$$

PILULÆ ANTIMONII COMPOSITÆ, U. S.—Compound Pills of Antimony. (*Plummer's Pills.*)—Each contains one-half grain sulphurated antimony, one-half grain calomel, and one grain guaiac. (See Pilulæ, Part II.)

PULVIS ANTIMONIALIS, U. S.—Antimonial Powder. (*James' Powder.*)—33 Gm. antimonous oxide; 67 Gm. precipitated calcium phosphate. (See Pulveres, Part II.)

VINUM ANTIMONII, U. S.—Wine of Antimony.—4 Gm. tartar emetic; 65 C.c. distilled water; 150 C.c. alcohol; stronger white wine to make 1000 C.c. (See Vina, Part II.)

ARSENIC. As; 74.9.

ACIDUM ARSENOSUM, U. S.—Arsenous Acid. As_2O_3; 197.68. (*Arsenic Trioxide. White Arsenic.*)—A heavy, white solid, occurring either as an opaque powder, or in transparent or semi-transparent masses, which usually have a striated appearance; odorless; tasteless; faintly acid reaction. Prepared by roasting arsenical ores, and resubliming the sublimate. "An anhydride, *not* a true acid."

The oxide (As_2O_3) becomes an acid (H_3AsO_3) when added to water:—

$$\underset{\text{Arsenous Oxide.}}{As_2O_3} + \underset{\text{Water.}}{3H_2O} = \underset{\text{Arsenous Acid.}}{2H_3AsO_3}.$$

LIQUOR ACIDI ARSENOSI, U. S.—Solution of Arsenous Acid. (*Liquor Arsenici Chloridi, Pharm. 1870.*)—A solution of arsenious acid in diluted hydrochloric acid. 10 Gm. arsenic; 50 C.c. diluted HCl; distilled water to 1000 C.c. No chemical reaction takes place.

LIQUOR POTASSII ARSENITIS, U. S.—Solution of Potassium Arsenite. (*Fowler's Solution.*)—10 Gm. arsenous acid; 20 Gm. $KHCO_3$; 30 C.c. tr. lavender comp.; distilled water to 1000 C.c.:—

$$\underset{\text{Acid Potassium Carbonate}}{2KHCO_3} + \underset{\text{Arsenous Oxide}}{As_2O_3} + \underset{\text{Water.}}{H_2O} = \underset{\text{Potassium Arsenite}}{2KH_2AsO_3} + \underset{\text{Carbon Dioxide.}}{2CO_2}.$$

When arsenous oxide is boiled with $KHCO_3$ in concentrated solution, potassium arsenite is produced, and CO_2 evolved. The quantity of water directed in the formula, however, is sufficient to dissolve the salts, so that a solution can be effected without any chemical change.

SODII ARSENAS, U. S.—Arsenate of Sodium. $Na_2HAsO_4 \cdot 7H_2O$; 311.9.—Made by fusing arsenous acid with sodium nitrate and carbonate.

LIQUOR SODII ARSENATIS, U. S. (See Liquores, Part II.)

ARSENI IODIDUM, U. S.—Arsenic Iodide. AsI_3; 454.49. (*Arsenici Iodidum, Pharm. 1870.*)—Glossy, orange-red, crystalline masses, or shining, orange-red, crystalline scales, gradually losing iodine when exposed to the air; iodine-like odor; iodine-like taste; neutral reaction. Made by fusing 1 p. of arsenic and 5 p. of iodine together.

LIQUOR ARSENI ET HYDRARGYRI IODIDI, U. S.—Solution of Arsenic and Mercuric Iodide. (*Liquor Arsenici et Hydrargyri Iodidi, Pharm. 1870. Donovan's Solution.*)—Solution should be light straw-color; if darker, free iodine is probably present. (See Liquores, Part II.)

BISMUTH. Bi; 208.9.

BISMUTHI CITRAS, U. S.—Bismuth Citrate. $BiC_6H_5O_7$; 397.44.—A white, amorphous powder, permanent in the air; odorless and tasteless. Prepared by boiling bismuth subnitrate with citric acid and water, and adding distilled water to the clear solution. The reaction is as follows:—

$$\underset{\text{Bismuth Subnitrate.}}{BiONO_3.H_2O} + \underset{\text{Citric Acid.}}{H_3C_6H_5O_7} = \underset{\text{Bismuth Citrate.}}{BiC_6H_5O_7} + \underset{\text{Nitric Acid.}}{HNO_3} + \underset{\text{Water.}}{2H_2O.}$$

BISMUTHI ET AMMONII CITRAS, U. S.—Bismuth and Ammonium Citrate.—Small, shining, pearly or translucent scales, becoming opaque on exposure to air; slightly acidulous and metallic taste; neutral or faintly alkaline reaction. Made by dissolving bismuth citrate in water of ammonia, evaporating the solution, and scaling.

BISMUTHI SUBCARBONAS, U. S.—Bismuth Subcarbonate. $(BiO)_2CO_3.H_2O$; 530.—A white, or pale yellowish-white powder, permanent in the air; odorless and tasteless. Made by dissolving bismuth in nitric acid, purifying, and precipitating by adding solution of sodium carbonate.

The most injurious impurity in bismuth is arsenic. In the official formula, directions are carefully made to leave out the arsenic. "The bismuth is first dissolved in nitric acid, a portion of which oxidizes the metal, with evolution of nitrous vapors, while another portion combines with the oxide produced, to form a bismuth nitrate. At the same time the arsenic is also oxidized at the expense of the nitric acid, and unites with a portion of the oxidized metal, so as to produce bismuth arsenate. Both of these salts, therefore, are contained in the solution, which is very concentrated. Both have the property, when their solution is diluted with water, of separating into two salts—one an insoluble subsalt, which is deposited, and the other a soluble acid salt, which is held in solution. But the arsenate is more disposed to the change than the nitrate, and requires for the purpose a smaller amount of water of dilution. The subarsenate is slowly deposited in twenty-four hours, and is then separated by filtration. The addition of a large quantity of distilled water precipitates the bismuth subnitrate, the ammonia being added to separate it more thoroughly by combining with the nitric acid. The precipitate thus freed from arsenic is now redissolved in nitric acid, partially diluted, and added to solution of sodium carbonate; by double decomposition bismuth subcarbonate and sodium nitrate are thus produced."—(Remington.)

BISMUTHI SUBNITRAS, U. S.—Bismuth Subnitrate. $BiONO_3.H_2O$; 306.—A heavy, white powder, permanent in the air; odorless; almost tasteless; slightly acid reaction. Prepared by dissolving bismuth in nitric acid, purifying and adding the solution, in nitric acid, to water. The reactions are as follows:—

$$\underset{\text{Bismuth.}}{Bi_2} + \underset{\substack{\text{Nitric}\\ \text{Acid.}}}{8HNO_3} = \underset{\substack{\text{Bismuth}\\ \text{Nitrate.}}}{(Bi3NO_3)_2} + \underset{\text{Water.}}{4H_2O} + \underset{\substack{\text{Nitrogen}\\ \text{Monoxide.}}}{2NO.}$$

then—

$$\underset{\substack{\text{Bismuth}\\ \text{Nitrate.}}}{5(Bi3NO_3)} + \underset{\text{Water.}}{8H_2O} = \underset{\substack{\text{Bismuth}\\ \text{Subnitrate.}}}{4BiONO_3H_2O} + \underset{\substack{\text{Bismuth}\\ \text{Nitrate.}}}{Bi3NO_3} + \underset{\substack{\text{Nitric}\\ \text{Acid.}}}{8HNO_3.}$$

"The separation of the arsenic is accomplished by first preparing the carbonate, by adding the solution of bismuth to a solution of sodium carbonate in excess, whereby most of the arsenic is retained in the solution, probably as sodium arsenate, while the insoluble carbonate is precipitated. This is dissolved, with the aid of heat, in nitric acid, so as to make a very concentrated solution of the nitrate, to which, when cold, just so much water is added as to begin to produce a permanent turbidness. The object of this is to allow any arsenic that may still be present to be deposited, which happens for reasons explained above. (See Subcarbonate.) The deposited matter having been precipitated, only the pure nitrate remains in solution, which is made to yield the subnitrate by a large dilution with water, and still more completely, by the addition of ammonia."—(Remington.)

GOLD AND PLATINUM.

Au; 196.7. Pt; 194.3.

AURI ET SODII CHLORIDUM, U. S.—Gold and Sodium Chloride.—An orange-yellow powder, slightly deliquescent in damp air; odorless; saline, metallic taste; slightly acid reaction. A mixture composed of equal parts of dry chloride of gold ($AuCl_3$) and chloride of sodium ($NaCl$). Made by dissolving gold in nitrohydrochloric acid, evaporating to dryness, weighing, and dissolving in eight times its weight of distilled water. Pure decrepitated common salt, equal in weight to the dry chloride, is then added, previously dissolved in four parts of water. The mixture is then evaporated to dryness, with constant stirring.

TEST-SOLUTION OF PLATINIC CHLORIDE.—1 p. chloride; 20 p. distilled water.

PART IV.

THE PREPARATIONS OF THE ORGANIC MATERIA MEDICA.

What is Organic Chemistry? *The science of the carbon compounds.*

The following pages treat of both official and non-official organic substances, and the former may be distinguished from the latter by the letters U. S. following the official names.

THE CELLULOSE GROUP.

CELLULOSE. $C_6H_{10}O_5$.

What is cellulose? The woody fibre of plants, forming the skeleton for the vegetable tissues.

What is lignin? "The substances which are found adhering to the cellulin skeleton of plants and vegetable tissues."

Describe pure cellulose. It is seen in the pure condition in raw cotton, the hairs of the seed of the cotton plant, and in many vegetable products. It is white, translucent, unalterable in the air; sp. gr. 1.5; insoluble in all the usual solvents, but soluble in ammoniacal solution of oxide of copper; converted into dextrin by treating with strong sulphuric or phosphoric acid, and, further, converted into glucose if the mixture be diluted with water and heated.

What is parchment-paper? Cellulose, in the form of unsized paper, after treatment with a mixture consisting of 2 p. H_2SO_4, sp. gr., 1.840, and 1 p. H_2O, by measure, cooled to 15° C. (59° F.), and washing in dilute NH_4HO.

For what is parchment-paper used in pharmacy? As a septum for dialysis.

What important principle in pharmacy is owing to the insolubility of cellulose in ordinary solvents? As cellulose forms the bulk of inert matter in plants, and is insoluble in ordinary solvents, active principles soluble in such solvents can be readily separated from it.

When used for the purpose of separating the active principles in plants from the inert cellulose, what are solvents called? Menstrua.

GOSSYPIUM PURIFICATUM, U. S.—Purified Cotton.* (*Gossypium, Pharm. 1880. Absorbent Cotton.*)—The hairs of the seeds of Gossypium herbaceum, freed from adhering impurities, and deprived of fatty matter. Cotton is freed from the trace of fatty matters always existing in raw cotton, by boiling it in a weak alkaline solution, rinsing it in a weak solution of chlorinated lime, to whiten it, dipping it in a very dilute solution of HCl, washing with cold water, drying, and carding. The loss is about 10 per cent.

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* *Purified* cotton wool is cellulose in one of its purest forms.

Products Resulting from the Decomposition of Cellulose.

CLASS I.—PRODUCTS MADE BY DECOMPOSING CELLULOSE OR LIGNIN BY THE ACTION OF ACIDS OR ALKALIES.

PYROXYLINUM, U. S.—Pyroxylin. (*Soluble Gun-Cotton. Colloxylin.*)—A very inflammable, slightly explosive substance, resembling cotton, formed by acting on cotton 1 Gm. with nitric acid 14 C.c., and sulphuric acid 22 C.c., for ten hours, or until a portion taken out is found soluble in a mixture consisting of 1 p. Alcohol, 3 p. Ether (by volume), after which it is washed and dried.

What is Pyroxylinum chemically? Di-nitro-cellulin. $C_6H_8(2NO_2)O_5$.

Explain its formation. It belongs to a series of closely related nitro-compounds of cellulin, formed by the action of nitric acid on this substance, in which the nitric acid radical replaces the hydroxyl of the cellulose formula. This may be shown by taking the double formula for cellulose $C_{12}H_{20}O_{10}$ and the displacement of the HO, thus:—

$6HNO_3$	+	$C_{12}H_{20}O_{10}$	=	$C_{12}H_{14}O_4(NO_3)_6$	+	$6H_2O$.
Nitric Acid.		Cellulose.		Cellulose-hexanitrate.		Water.
$5HNO_3$	+	$C_{12}H_{20}O_{10}$	=	$C_{12}H_{15}O_5(NO_3)_5$	+	$5H_2O$.
Nitric Acid.		Cellulose.		Cellulose-pentanitrate.		Water.
$4HNO_3$	+	$C_{12}H_{20}O_{10}$	=	$C_{12}H_{16}O_6(NO_3)_4$	+	$4H_2O$.
Nitric Acid.		Cellulose.		Cellulose-tetranitrate.		Water.
$3HNO_3$	+	$C_{12}H_{20}O_{10}$	=	$C_{12}H_{17}O_7(NO_3)_3$	+	$3H_2O$.
Nitric Acid.		Cellulose.		Cellulose-trinitrate.		Water.
$2HNO_3$	+	$C_{12}H_{20}O_{10}$	=	$C_{12}H_{18}O_8(NO_3)_2$	+	$2H_2O$.
Nitric Acid.		Cellulose.		Cellulose-dinitrate.		Water.

The soluble pyroxylin used in preparing collodion is a varying mixture of the di- tri- tetra- and pentanitrates. The hexanitrate is the true explosive gun-cotton, and is insoluble in ether, alcohol and water.

Celluloid.—A substance made from pyroxylin, camphor and coloring matter heated together and powerfully pressed into appropriate moulds.

Pyroxylin was once extensively employed by photographers for producing the basis of the sensitized film upon which impressions are made. It is now replaced to a great extent by gelatin.

Pharmaceutically pyroxylin is used in collodion. (See Collodia, Part II.)

ACIDUM OXALICUM.—Oxalic Acid. $H_2C_2O_42H_2O$; 125.7.—Small, colorless, prismatic crystals; odorless, and with a very sour taste. Made by acting on cellulin, sugar, or starch, with nitric acid; but prepared on a commercial scale by heating sawdust with a mixture of two molecules caustic soda and one molecule potassa. The gray mass resulting is washed with Na_2CO_3, whereby the potash is removed as carbonate, and the less soluble sodium oxalate remains. This is converted into calcium oxalate by milk of lime, and then decomposed with H_2SO_4, and purified by recrystallization.

Products Resulting from the Destructive Distillation of Cellulose and

What occurs when wood is

Several solid, liquid, and
cipal ones are the followi

Solid.—Charcoal,

containing *acetic*, *formic*, *butyric*, *crotonic*, *capronic*, *propionic acids*, *acetone*, *methylic alcohol*, *furfurol*, *methylamine*, *pyrocatechin*, and small quantities of empyreumatic oils and resins. 2. Tarry liquid, containing *toluol*, *xylol*, *cumol*, *methol*, *mesitylene*, *pseudocumol*, *phenol*, *cresol*, *guaiacol*, *creasol*, *phlorol*, and *methylcreasol*, *naphthalene*, *paraffin*, *pyrene*, *chrysene*, *retene*, *mesit*. GASES.—*Carbon dioxide*, *carbon monoxide*, *marsh gas*, *acetylene*, *ethylene*, *propene*, and others.

Which are the most important of these? Charcoal, tar, acetic acid, acetone, methylic alcohol, and creosote.

ACIDUM ACETICUM, U. S.—Acetic Acid. $HC_2H_3O_2$; 59.86. —A clear, colorless liquid, with a strong vinegar-like odor, purely acid taste, strongly acid reaction, composed of 36 per cent. absolute acetic acid and 64 per cent. water. Made by distilling oak wood at a temperature much less than that necessary to produce charcoal.

Acetic acid is also made by distilling *vinegar*, which, in turn, is made by oxidizing dilute alcoholic liquids. In Germany it is made by oxidizing alcohol, by pouring a very dilute alcoholic solution on beech wood shavings, which exposes a large surface to the air.

What two strengths of acetic acid are found in commerce? The official acid and No. 8 acid. The former has a sp. gr. of 1.048, the latter 1.040, and is 20 per cent. weaker. It is called No. 8 acid because it was formerly used in the proportion of 1 to 8, to make dilute acetic acid or distilled vinegar.

ACIDUM ACETICUM DILUTUM, U. S.—Diluted Acetic Acid.—The liquid used as the menstruum for the official vinegars, containing 6 per cent. absolute $HC_2H_3O_2$; sp. gr. 1.008. Made by diluting 100 Gm. acetic acid with 500 Gm. distilled water, to make 600 Gm.

ACIDUM ACETICUM GLACIALE, U. S.—Glacial Acetic Acid. $HC_2H_3O_2$; 59.86.—A clear, colorless liquid, of a strong, vinegar-like odor, and a very pungent, purely acid taste. Somewhat below 15° C. (59° F.), a crystalline solid; nearly or quite absolute acetic acid; sp. gr., not higher than 1.058, at 15° C. (59° F.). Made by heating sodium acetate until the water of crystallization has been driven off, powdering the residue, and distilling it with concentrated sulphuric acid. The reaction is as follows:—

$$\underset{\substack{\text{Sodium}\\\text{Acetate.}}}{NaC_2H_3O_2} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{H_2SO_4} = \underset{\substack{\text{Glacial}\\\text{Acetic Acid.}}}{HC_2H_3O_2} + \underset{\substack{\text{Acid Sodium}\\\text{Sulphate.}}}{NaHSO_4}.$$

PIX LIQUIDA, U. S.—Tar.—An empyreumatic oleoresin, obtained by the destructive distillation of the wood of *Pinus Palustris* and of other species of *pinus*. It is usually obtained as a by-product in the manufacture of charcoal or acetic acid. A thick, viscid semi-fluid, blackish-brown, heavier than water, transparent in thin layers, becoming granular or opaque by age; having an acid reaction, an empyreumatic terebinthinate odor, and a sharp, empyreumatic taste; slightly soluble in water, soluble in alcohol, in fixed or volatile oils, and in solution of potassa or of soda.

Official Preparations.—Syrupus Picis Liquidæ, Unguentum Picis Liquidæ.

***OLEUM PICIS LIQUIDÆ*, U. S.—Oil of Tar.**—An almost colorless liquid, distilled from tar, soon acquiring a dark, reddish-brown color when exposed to the air; having a strong, tarry odor and taste and acid reaction; sp. gr. about 0.970.

Black Pitch.—The residue left after the distillation of tar.

OLEUM CADINUM, U.S.—Oil of Cade. (*Oleum Juniperi Empyreumaticum.*)—A product of the dry distillation of the wood of Juniperus Oxycedrus. A dark brown, clear, thick liquid, having an empyreumatic odor and burning taste. Sp. gr. about 0.990.

CREOSOTUM, U. S.—Creosote.—An almost colorless or yellowish-pinkish, highly refractive, oily liquid, turning to reddish-yellow or brown by exposure to light; penetrating, smoky odor; burning, caustic taste; neutral reaction; sp. gr. not below 1.070 at 15° C (59° F.).

Creosote is a production of the distillation of wood-tar, consisting, mainly, of the following phenols; *guaiacol* or *oxycresol*, $C_7H_8O_2$, boiling at 200° C. (392° F.); *creosol*, $C_8H_{10}O_2$, boiling at 217° C. (422.6° F.); *methylcreosol*, $C_9H_{12}O_2$, boiling at 214° C. (417° F.) to 218° C. (424.4° F.); *phlorol*, $C_8H_{10}O_1$, boiling at 219° C. (426.2° F.).

When wood tar is distilled, a solution of several layers is formed. The lower, oily layer is treated with K_2CO_3, to neutralize the acid present. Fractional distillation, with alternate treatment of the distillate with H_2SO_4 and KHO, to separate impurities, and final distillation, yields the product called creosote, which comes over between 205° and 220° C. (401° and 428° F.).

Nearly all of the liquid sold for creosote in the market is impure carbolic acid or coal tar creosote. It is distinguished from true wood creosote in the following manner: Creosote does not coagulate albumen or collodion. (For other tests, see U. S. P.)

Official Preparation.—Aqua Creosoti.

Products Resulting from the Natural Decomposition of Cellulin and Lignin and their Derivatives.

Coal.—A fossil formation found in the earth, formed by the decomposition of cellulin, lignin, etc., under the changing influence of moisture, temperature, and pressure.

Coal Tar.—A residue left after the dry distillation of bituminous coal in the process of making illuminating gas. It consists of a large number of products in the forms of solids, liquids, and gases, a number of which form very valuable products in the arts.

NAPHTALINUM, U. S.—Naphtalin. $C_{10}H_8$; 127.7. (*Naphtalene.*)—A hydrocarbon obtained from coal tar. Colorless, shining, transparent laminæ, having a strong, characteristic odor resembling that of coal-tar, and a burning, aromatic taste; slowly volatilized on exposure to the air. Insoluble in water, but when boiled with the latter imparting to it a faint odor and taste. Soluble in 15 parts of alcohol at 15° C. (59° F.), and very soluble in boiling alcohol; also very soluble in ether, chloroform, carbon disulphide, and fixed or volatile oils. May be obtained by subjecting coal-tar to distillation, when it passes over after the coal naphtha. Frequently produced by dry distillation of organic bodies. Also known as *coal-tar camphor*, and employed to prevent the ravages of moth in woolen clothing.

NAPHTOL, U. S.—Naphtol. $C_{10}H_7OH$; 143.66. (*Beta-Naphtol.*) A phenol occurring in coal-tar, but usually prepared artifically from naphtalin. Colorless, or pale buff-colored, shining, crystalline laminæ, or a white, or yellowish white, crystalline powder, having a faint, phenol-like odor and a sharp and pungent, but not persistent, taste. Permanent in the air. Soluble at 15° C. (59° F.), in about 1000 parts of water, and in 0.75 part of alcohol; in about 75 parts of boiling water, and very soluble in boiling alcohol. Also very soluble in ether, chloroform, or solution of caustic alkalies. Prepared by digesting 4 p. naphtalin with 3 p. H_2SO_4 at 80° C. by which *a*- and *β-naphtalin-sulphonic acids* are produced; formula $C_{10}H_7SO_3H$. These may be separated by Ba or Pb salts. When treated with H_2SO_4, the *a*-acid passes into the *β*, therefore, the latter acid is produced exclusively at high temperatures (160° C.). When fused with alkaline hydrates both of the acids yield their corresponding naphtols, known as *a*- and *β*-naphtols, respectively.

When naphtalin is digested with H_2SO_4 two acids are formed, one of them being known as alpha-naphtalin-sulphonic acid. When this acid is heated with H_2SO_4, beta-naphtalin-sulphonic acid results. By fusing the latter acid with an alkaline hydrate, beta-naphtol (the official naphtol) is produced.

ACETANILIDUM, U. S.—Acetanilid. $C_6H_5NH.C_2H_3O$; 134.73. (*Phenylacetamide.*)—An acetyl derivative of aniline, occurring in white, shining, micaceous, crystalline laminæ, or a crystalline powder, odorless, having a faintly burning taste, and permanent in the air. Soluble at 15° C. (59° F.), in 194 parts of water, and in 5 parts of alcohol; in 18 parts of boiling water, and in 0.4 part of boiling alcohol; also soluble in 18 parts of ether, and easily soluble in chloroform, melting at 113° C. (235.4° F.), and consumed without residue when ignited.

Acetanilidum, also known as antifebrin, is made by heating a mixture of aniline and glacial acetic acid to the boiling point; the cooled, congealed residue is purified by sublimation or recrystallization.

ACIDUM CARBOLICUM CRUDUM, U. S.—Crude Carbolic Acid.—A liquid consisting of various constituents of coal-tar, chiefly cresol and phenol, obtained during the fractional distillation of coal-tar. The portion coming over between 165° C., and 190° C. (329°–374°F.) is known as "dead oil" because once deemed valueless. When dead oil is redistilled the product is Crude Carbolic Acid. If the latter is redistilled, water (principally) comes over, but when distillation is carried on between 165° to 185° C. (329°–365° F.) nearly pure and crystallizable phenol (carbolic acid) results; above this temperature 185° C. to 195° C. (365°–383° F.) the distillate consists mainly of cresol and other phenols, (uncrystallizable). At temperatures from 195° C. to 211° C. (383°–411.8° F.), cresol, C_7H_8O, and xylenol, $C_8H_{10}O$, are obtained. A nearly colorless or reddish-brown liquid, of a strongly empyreumatic and creosote-like odor, having a benumbing, blanching, and caustic effect on the skin or mucous membrane, and a slightly acid reaction.

ACIDUM CARBOLICUM, U. S.—Carbolic Acid. C_6H_5HO; 93.78. (*Phenol.*)—Colorless, separate or interlaced, needle-shaped crystals, or a white, crystalline mass, sometimes acquiring a reddish tint; de-

liquescent on exposure to moist air. It produces a benumbing, blanching, and caustic effect on the skin. It has a distinctive, slightly aromatic odor, resembling creosote; when diluted, a sweetish taste, with a slightly burning after-taste; faintly acid reaction; and is a product of the distillation of coal-tar between the temperatures of 180° C. and 190° C. (356°–374° F.).

Official Preparations.—Glyceritum Acidi Carbolici, Unguentum Acidi Carbolici.

RESORCINUM, U. S.—Resorcin. $C_6H_4(OH)_2$; 109.74 (*Resorcinol. Metadioxybenzol.*)—A diatomic phenol, colorless, or faintly reddish, needle-shaped crystals or rhombic plates, having a faint, peculiar odor, and disagreeable, sweetish, and afterward pungent taste. Resorcin acquires a reddish or brownish tint by exposure to light and air. Soluble at 15° C. (59° F.), in 0.6 part of water, and in 0.5 part of alcohol; very soluble in boiling water or in boiling alcohol; also readily soluble in ether or glycerin; very slightly soluble in chloroform. Usually prepared by fusing sodium benzol disulphonate with caustic soda, but may be made in several other ways. It is a diatomic phenol isomeric with *pyrocatechin* and *hydroquinone.*

ACIDUM SALICYLICUM, U. S.—Salicylic Acid. $HC_7H_5O_3$; 137.67.—Fine, white, light, prismatic, needle-shaped crystals, permanent in the air,; free from odor of carbolic acid; having sometimes, a slight aromatic odor; sweetish and slightly acrid taste; acid reaction. Prepared by treating sodium phenol (or carbolate) with carbon dioxide. The sodium phenol is prepared by evaporating to dryness equal amounts of concentrated caustic soda solution and phenol; this is then heated to 100° C. (212° F.), while a stream of dry CO_2 is passed over it. The temperature is gradually raised as soon as the phenol distills over, until it reaches 250° C. (482° F.), until no more phenol distills. Half of the phenol used remains in the retort, as sodium salicylate, while the other half distills over unchanged. The reaction is as follows:—

$$\underset{\text{Sodium Phenol.}}{C_6H_5ONa} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{CO_2} = \underset{\substack{\text{Phenol. Normal Sodium}\\\text{Salicylate.}}}{C_6H_4OH.COONa.}$$

The normal sodium salicylate thus obtained is then decomposed by HCl, and the salicylic acid is filtered out, washed and crystallized, or purified by sublimation and superheated steam or by dialysis.

SALOL, U. S.—Salol. $C_6H_5C_7H_5O_3$; 213.49. (*Phenyl Salicylate.*)—The salicylic ether of phenol. A white, crystalline powder, odorless, or having a faintly aromatic odor, and almost tasteless. Permanent in the air. Almost insoluble in water; soluble in 10 parts of alcohol at 15° C. (59° F.); very soluble in boiling alcohol; also soluble in 0.3 part of ether, and readily in chloroform, and in fixed and volatile oils. Prepared by heating salicylic acid with phenol in the presence of phosphorus pentachloride or phosphorus oxychloride; the elements of water are withdrawn by this action, and the phenol group is caused to unite with the salicylic radical.

AMYLACEOUS AND MUCILAGINOUS PRINCIPLES AND THEIR PRODUCTS.

AMYLUM, U. S.—Starch.—The fecula of the seed of *Zea Mays*, occurring in irregular, angular masses, which are easily reduced to powder of a white color; under the microscope appearing as granules, mostly very minute, more or less angular in form, and indistinctly striated, but with a distinct hilum near the centre. Inodorous and tasteless.

Starch is present in many drugs and is an important constituent of many vegetable foods. It is usually made from potatoes by separating the cellular substance from the starch, by grating and pressing the soft mass upon a sieve, the starch granules falling through. It may be, also, prepared from wheat or corn, by allowing the grain to ferment, which disintegrates it, and stopping the fermentation before the starch is affected. The quality of starch depends largely upon the quality and purity of the water used in washing it.

Chemical Composition of Starch.—It has the same chemical composition as cellulose, $C_6H_{10}O_5$, and is closely allied to it and its properties.

Office of Starch in the Vegetable Kingdom.—It is stored up in plants as a food, in anticipation of future usefulness in the formation of plant tissues.

Description of the Starch Granule.—In young plants the starch granule is always spherical, but it subsequently becomes ovoid, lenticular, polyhedral, or irregular in shape. Various plants exhibit characteristic starch granules peculiar to each, which may be identified by the microscope. The granule occurs in concentrically arranged layers of different densities, arranged around a central point, usually situated at one end of the granule, and called the *hilum*.

GLYCERITUM AMYLI, U. S.—Glycerite of Starch. (*Starch Jelly.*)—10 p. starch; 90 p. glycerin.

CETRARIA, U. S.—Cetraria. (*Iceland Moss.*)—A lichen found in northern latitudes, on both continents, named *cetraria islandica*, containing 70 per cent. *lichenin*, $C_{12}H_{20}O_{10}$ (strongly allied to starch, which swells up in water); about 3 per cent. *cetraric acid*, $C_{18}H_{16}O_8$ (crystalline and very bitter); *lichenstearic acid*, $C_{14}H_{24}O_3$; sugar, oxalic acid, fumaric acid, and cellulin.

DECOCTUM CETRARIÆ, U. S.—Decoction of Cetraria.—(See Decocta, Part II.)

In the official process for this preparation, the cetraria is first macerated with water, and expressed before it is finally boiled with water, to separate the bitter principle, cetraric acid.

CHONDRUS, U. S.—Chondrus (*Irish Moss.*)—An alga growing in the Atlantic Ocean, named *Chondrus crispus*, containing 70 per cent. *carrageenin*, a mucilaginous principle, differing from gum by not precipitating with alcohol; from starch, by not becoming blue with iodine; and from pectin, by not precipitating with subacetate of lead.

GUMS AND MUCILAGINOUS SUBSTANCES.

GUM, now known by the name, *arabin*, is a vegetable substance, forming a thick, glutinous liquid with water; insoluble in alcohol, and converted into mucic and oxalic acid with nitric acid.

Three Proximate Principles found in Gums.—Arabin, or arabic acid, $C_{12}H_{22}O_{11}$ (soluble), found in acacia; bassorin, $C_{12}H_{20}O_{10}$ (insoluble), found in tragacanth; cerasin (insoluble) found in cherry gum.

Gums differ from starch or cellulin by being soluble in water or by swelling up in contact with it.

They differ from sugar by being incapable of vinous fermentation with yeast.

ACACIA, U. S.—Acacia. (*Gum Arabic.*)—A gummy exudation from *Acacia Senegal*, consisting, mainly, of calcium, potassium, or magnesium arabate; occurring in roundish or amorphous pieces, or irregular fragments of various sizes, more or less transparent, hard, brittle, pulverizable, and breaking with a shining fracture. It is usually white or yellowish-white, but frequently presents different shades of red, and is sometimes of a deep orange or brownish color. It is bleached by exposure to the sun. In powder it is always white. It is inodorous, has a feeble, slightly sweetish taste, and, when pure, dissolves in the mouth; sp. gr., 1.31 to 1.525. At ordinary temperatures, it forms a thick, glutinous liquid, of distinctly acid reaction when dissolved in water. It does not precipitate with neutral lead acetate, but the basic acid forms a precipitate, even with dilute solution. Solutions of ferric salts, silicates and borates render gum solution turbid or thicken it to jelly. Iodine, silver, and mercuric chloride produce no alteration. Ammoniacal solution of cupric oxide dissolves it.

Official Preparations.—Mucilago Acaciæ, Syrupus Acaciæ.

TRAGACANTHA, U. S.—Tragacanth.—A gummy exudation from *Astragalus gummifer* and from other species of *Astragalus*, consisting of 33 per cent. of bassorin, 53 per cent. soluble gum (not arabin), 11 per cent. water, 3 per cent. impurities; occurring either in flaky, leaf-like pieces or in tortuous, vermicular filaments, of a whitish color, somewhat translucent and resembling horn in appearance; hard, and more or less fragile, but difficult of pulverization unless exposed to a freezing temperature or thoroughly dried and powdered in a heated mortar; odorless; very little taste; sp. gr. 1.384; introduced into water, it absorbs a certain proportion, swells very much, and forms a soft, adhesive paste, but does not dissolve; agitated with an additional quantity of water, this paste forms a uniform mixture; but in the course of one or two days, the greater part separates, and is deposited, leaving a portion dissolved in the supernatant fluid; the gelatinous mass is turned blue by iodine, and the fluid portion is not precipitated by alcohol; wholly insoluble in alcohol. Tragacanth appears to be composed of two different constituents, one resembling acacia, soluble in water; the other insoluble, but swelling in water. The former differs from acacia in affording no precipitate with potassium silicate or ferric chloride.

Official Preparation.—Mucilago Tragacanthæ.

ULMUS, U. S.—Elm. (*Slippery Elm.*)—The inner bark of *Ulmus fulva*, containing a mucilage precipitated by alcohol and lead acetate.

Official Preparation.—Mucilago Ulmi.

SASSAFRAS MEDULLA, U. S.—Sassafras Pith.—The pith of *Sassafras variifolium*, containing a delicate mucilage, which is not precipitated by alcohol.

Official Preparation.—Mucilago Sassafras Medullæ.

ALTHÆA, U. S.—Althæa. (*Marshmallow.*)—The root of *Althæa officinalis*, containing a large quantity of mucilage, $C_{12}H_{20}O_{10}$, associated with *asparagin*, sugar, and starch.

Official Preparation.—Syrupus Althææ.

LINUM, U. S.—Linseed.—The seed of *Linum usitatissimum*, containing 15 per cent. mucilage, $C_{12}H_{20}O_{10}$, in the epithelium, and 20 to 35 per cent. fixed oil in the nucleus, besides resin, sugar, wax, etc. The mucilage is soluble in water, readily soluble in hot water, forming a thick, viscid liquid, precipitated by alcohol and subacetate of lead.

SUGARS AND SACCHARINE SUBSTANCES.

Sugars are organic bodies, having a sweet taste, generally of vegetable origin and crystallizable; of a neutral reaction; soluble in water, their solutions being optically active to polarized light.

Two Classes of Sugar.—Fermentable and non-fermentable sugars.

1. FERMENTABLE SUGARS are the most important, being largely consumed in food products. The fermentable sugars are divided into two sub-classes—*glucoses*, or sugars *directly* subject to vinous fermentations, and *saccharoses*, or sugars *indirectly* subject to vinous fermentation.

GLUCOSES. $C_6H_{12}O_6$.—The formula for the *glucoses* is $C_6H_{12}O_6$. The principal ones are—*glucose* (dextro-glucose or dextrose), which rotates the plane of polarization strongly to the right; obtained by treating starch with H_2SO_4 and lime, separating the $CaSO_4$, and evaporating the solution. *Grape sugar* (crystallized glucose); obtained by crystallizing the above solution. *Lævulose* (lævo glucose) rotates the plane of polarization strongly to the left; found in sugar cane. *Maltose*, $C_{12}H_{22}O_{11} + H_2O$; obtained by action of diastase on starch, etc.

GLUCOSE, $C_6H_{12}O_6$, is prepared by the action of dilute H_2SO_4 upon starch. It may also be obtained from candied sugar, grapes, and other sources. Glucose is the term applied to the syrupy preparation, grape sugar to the solid product. The process is as follows: Corn is first soaked in warm water, then ground with a stream of water, the starch washed from the meal in a trough with bolting cloth bottom, beaten with caustic soda, to separate the gluten, washed and treated with dilute H_2SO_4 and steam. This process is called "open conversion," and takes about two hours. Or the substances are acted upon with superheated steam, in a closed cylinder. This is called "close conversion, and takes about fifteen minutes. After conversion, the substances are treated with marble dust and animal charcoal, filtered, and evaporated in *vacuo*.

Glucose can be obtained as a hydrate, in small and laminated crystals, from aqueous solutions, and anhydrous in hard, crystalline masses, either from alcoholic solutions or from very concentrated aqueous solutions.

Properties.—Less sweet than cane sugar; less soluble in water, more soluble in alcohol; sp. gr. 1.54–1.57, when anhydrous. Strong mineral acids act sparingly on it, but with facility on cane sugar. Alkalies readily destroy it, but form definite compounds with cane sugar. Boiled with water, it suffers very little alteration; rotates polarized light to the right; undergoes vinous fermentation directly; reduces alkaline tartrate of copper, producing a reddish precipitate.

SACCHAROSES, $C_{12}H_{22}O_{11}$.—The peculiar characteristic of sugars of this class is, that they are fermentable only after being converted into glucoses.

Principal Saccharoses.—Cane sugar (saccharose), from sugar cane, beets, etc.; para-saccharose, by fermenting spontaneously cane sugar; milk sugar (lactose, lactin), from milk.

2. NON-FERMENTABLE SUGARS. (Sometimes called saccharoids.)

Principal non-fermentable sugars. Mannite, $C_6H_{14}O_6$; dulcite, $C_6H_{14}O_6$; eucalyn; inosite, etc., etc.

SACCHARUM, U. S.—Sugar. $C_{12}H_{22}O_{11}$; 341.2.—The refined sugar of *Saccharum officinarum*, made, commercially, from sugar cane, beet root, and sorghum; occurring in white, dry, hard, distinctly crystalline granules, permanent in the air; odorless; purely sweet taste; neutral reaction. Prepared by crushing and expressing sugar cane, adding calcium bisulphite and a little lime, heating, straining, evaporating, cooling, and stirring, transferring to casks perforated at the bottom, and the crystals drained. This is known as the open-pan process. The vacuum-pan process, which now almost completely displaces it, consists in removing the lime by CO_2, filtering through bone-black, concentrating in a vacuum-pan, crystallizing, and drying the crystals in "centrifugals" by rapid revolutions.

The best sugar for pharmaceutical uses is granulated sugar, as it is not liable to absorb moisture, like loaf sugar, and does not lose weight when kept in dry air.

Rock Candy.—Crystallized sugar. Sp. gr. 1.606.

MEL, U. S.—Honey.—A saccharine secretion deposited in the honey-comb by *Apis mellifica*, and occurring as a syrupy liquid, of a light yellowish or pale brownish-yellow color, translucent, gradually becoming crystalline and opaque; characteristic odor; sweet, faintly acrid taste.

MANNA, U. S.—Manna.—A concrete, saccharine exudation of *Fraxinus ornus*, usually occurring of a yellowish-white color externally; internally white, porous, and crystalline; sp. gr. 0.834. When pure, it is soluble in three parts of cold water and its own weight of boiling water. It separates, in crystalline masses, from a boiling saturated aqueous solution; soluble in alcohol, and depositing, from a boiling alcoholic solution, beautiful crystals of a peculiar, sweet principle, found in manna and many other plants, called *mannite*.

GLYCYRRHIZA, U. S.—Glycyrrhiza. (*Liquorice Root.*)—The root of *glycyrrhiza glabra*, and of the variety *glandulifera*, containing the sweet principle *glycyrrhizin*, or *glycyrrhizic acid*, $C_{44}H_{63}NO_{18}$, existing in the root, in combination with ammonium.

Official Preparations.—Extractum Glycyrrhizæ, Extractum Glycyrrhizæ Purum, Pulvis Glycyrrhizæ Compositus, Extractum Glycyrrhizæ Fluidum.

GLYCYRRHIZINUM AMMONIATUM, U. S.—Ammoniated Glycyrrhiza.—Made by percolating liquorice root with water, adding H_2SO_4 as long as a precipitate is produced, and redissolving the precipitate in water with the aid of NH_4HO, and scaling. Yield, about 10 per cent.

TRITICUM, U. S.—Triticum. (*Couch Grass.*)—The rhizome of *Agropyrum repens*, gathered in the spring, and deprived of the roots, containing *triticin*, a principle resembling inulin, also glucose, lævulose, etc.

Official Preparation.—Extractum Tritici Fluidum.

Derivatives of Sugar through the Action of Ferments.

Fermentation.—Decomposition occurring in organic bodies on exposure to the action of moisture, air and a warm temperature, resulting in the formation of new products. When the products are worthless or offensive, the process is called *putrefaction;* when useful, it is called *fermentation.*

Causes of Fermentation.—The present theory is, that fermentation is caused by the presence of certain micro-organisms, called *bacteria.*

Two Classes into which Ferments are Divided.—Ferments are divided into two classes—organized, or physiological ferments, as yeast, mycoderms, torulas, etc., and unorganized, or chemical ferments, like diastase, synaptase, myrosin, etc.

Vinous Fermentation.—The decomposition of cane sugar into alcohol and carbon dioxide, which occurs when sugar is exposed to the action of water, air, and a warm temperature, and seems to be caused by a microscopic plant, which has been named *Torula cerevisiæ.*

Result of the Action of Dilute Acids and Ferments on Cellulin and Starch.—They are converted into alcohol or acetic acid :—

$$\underset{\substack{\text{Cellulose}\\\text{or Starch.}}}{(C_6H_{10}O_5)_3} + \underset{\text{Water.}}{H_2O} = \underset{\text{Maltose.}}{C_{12}H_{22}O_{11}} + \underset{\text{Starch.}}{C_6H_{10}O_5};$$

then,

$$\underset{\text{Maltose.}}{C_{12}H_{22}O_{11}} + \underset{\text{Starch.}}{C_6H_{10}O_5} + \underset{\text{Water.}}{2H_2O} = \underset{\text{Glucose.}}{(C_6H_{12}O_6)_3};$$

then,

$$\underset{\text{Glucose.}}{C_6H_{12}O_6} = \underset{\text{Alcohol.}}{(C_2H_5HO)_2} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{2CO_2}.$$

If the process is not stopped here, the alcohol is oxidized into acetic acid :—

$$\underset{\text{Alcohol.}}{C_2H_5HO} + \underset{\text{Oxygen.}}{O_2} = \underset{\text{Acetic Acid.}}{C_2H_4O_2} + \underset{\text{Water.}}{H_2O}.$$

The most important derivative of sugar through the action of a ferment is *alcohol*, usually obtained from whiskey by distillation.

The distilled products of vinous liquors forming the different ardent spirits of commerce are: *brandy*, from wine; *rum*, from fermented molasses; *whiskey*, from cider, malted barley or rye; *Holland gin*, from malted barley and rye meal, with hops, and rectified from juniper berries; *common gin*, from malted barley, rye, or potatoes, and rectified from turpentine; *arrack*, from fermented rice.

The compounds derived from sugars may be considered under three heads: 1st. Ethyl hydrate and oxide, and their preparations; 2d. Preparations of the compound ethers of the ethyl and amyl series; 3d. Aldehyd, its derivatives and preparations.

Ethyl Hydrate and Oxide, and their Preparations.

Alcohol is a term used to designate a class of carbon compounds called *alcohols*. Alcohols are hydrates of the radicals *ethyl*, *amyl*, etc., just as calcium hydrate is the hydrate of the metal calcium.

Ethers are the oxides of the radicals, just as the calcium oxide is the oxide of the metal calcium.

Compound ethers are analogous to the salts of metals, just as potassium nitrate, sodium acetate, etc., are compounds of the metals potassium and sodium with the acidulous radicals characterizing nitrates and acetates. They are formed by the decomposition of their alcohols (hydrates) by acids, just as calcium sulphate may be produced by decomposing hydrate of calcium. Water is formed as one of the results of the decomposition.

The following reactions will illustrate the formation of compound ethers :—

$$\underset{\substack{\text{Sodium}\\\text{Hydrate.}}}{NaHO} + \underset{\substack{\text{Acetic}\\\text{Acid.}}}{HC_2H_3O_2} = \underset{\substack{\text{Sodium}\\\text{Acetate.}}}{NaC_2H_3O_2} + \underset{\text{Water.}}{H_2O.}$$

$$\underset{\substack{\text{Alcohol, or}\\\text{Ethyl Hydrate.}}}{C_2H_5HO} + \underset{\substack{\text{Acetic}\\\text{Acid.}}}{HC_2H_3O_2} = \underset{\text{Ethyl Acetate.}}{C_2H_5C_2H_3O_2} + \underset{\text{Water.}}{H_2O.}$$

ALCOHOL, U. S.—A liquid composed of 91 per cent. by weight (94 per cent. by volume) of ethyl alcohol (C_2H_5HO; 46.9) and 9 per cent. by weight of water. Sp. gr. 0.820 at 15.6° C. (60° F.), and 0.812 at 25° C. (97° F.); occurring as a transparent, colorless, mobile, and volatile liquid, of a characteristic, pungent, and agreeable odor and a burning taste. Boiling at 78° C., and usually obtained by distilling *whiskey*, redistilling, and rectifying.

Impurities.—Alcohol is liable to contain *fusel oil*, or *amylic alcohol*, giving it a characteristic odor. It may be deprived of odor by treating it with potassium permanganate and redistilling.

Absolute Alcohol.—Alcohol entirely free from water. It is prepared by separating the 11 per cent. of water from the strongest alcohol that can be made by distillation, by the use of recently burned lime, out of contact with the air, and redistilling *in vacuo*. Its freedom from water may be tested with anhydrous baryta, or by its forming a clear solution when mixed with an equal bulk of pure benzol.

ALCOHOL DILUTUM, U. S.—Diluted Alcohol.—A liquid composed of 41 per cent. by weight (48.6 per cent. by volume) of ethyl alcohol, and 59 per cent. of water; sp. gr. about 0.938 at 15° C (59° F.), and 0.930 at 25° C. (77° F.). Alcohol, distilled water, each 500 C.c. or each 1 pint. Mix them. Or alcohol 410 Gm., water 500 Gm. (41 oz. av. and 50 oz. av.). Mix them.

Rule for Preparing Diluted Alcohol from Alcohol of any Higher Percentage.—" Divide the alcoholic percentage of the alcohol to be diluted by 45.5 and substract 1 from the quotient. This gives the number of parts of water to be added to 1 part of the alcohol." All terms denote weight in this rule.

Result if Alcohol and Water are mixed together.—A rise in temperature and a contraction of volume takes place. (55 gallons of alcohol + 45 gallons of water equals 96¼ gallons—a loss of 3¾ gallons.)

United States Proof Spirits.—U. S. *proof spirit* contains 50 per cent. by volume of absolute alcohol.

ALCOHOL ABSOLUTUM, U. S.—Absolute Alcohol. C_2H_5-OH; 45.9.—Ethyl alcohol, containing not more than 1 per cent. by weight of water. A transparent, colorless, mobile, and volatile liquid, of a characteristic, rather agreeable odor, and a burning taste. Sp. gr. 0.797.

ALCOHOL DEODORATUM, U. S.—Deodorized Alcohol.—A liquid composed of about 92.5 per cent. by weight, or 95.1 per cent. by volume of ethyl alcohol (C_2H_5OH; 45.9), and about 7.5 per cent. by weight of water. Sp. gr. about 0.816 at 15° C. (59° F.).

Whiskey and brandy are referred to under Spiritus, Part II.

ÆTHER, U. S.—Ether. (*Æther Fortior, Pharm. 1880*).—A liquid composed of about 96 per cent. by weight of absolute ether, or ethyl oxide, $(C_2H_5)_2O$; 73.84, and about 4 per cent. of alcohol containing a little water; sp. gr. about 0.725 to 0.728. A thin and very diffusive, clear, and colorless liquid. Refreshing, characteristic odor; burning and sweetish taste, slightly bitter after-taste, neutral reaction. Made by acting on alcohol with H_2SO_4, between the temperatures of 130° and 137.7° C. (266° and 280° F.). The following reactions occur:—

$$\underset{\text{Alcohol.}}{C_2H_5HO} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{H_2SO_4} = \underset{\substack{\text{Ethyl sulphuric}\\\text{Acid.}}}{C_2H_5HSO_4} + \underset{\text{Water.}}{H_2O};$$

then,

$$\underset{\substack{\text{Ethyl-sulphuric}\\\text{Acid.}}}{C_2H_5HSO_4} + \underset{\text{Alcohol.}}{C_2H_5HO} = \underset{\text{Ether.}}{(C_2H_5)_2O} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{H_2SO_4}.$$

It will be seen that the sulphuric acid is not consumed in the process, but is regenerated, so that theoretically the making of ether is continuous.

SPIRITUS ÆTHERIS, U. S.—Spirit of Ether.—Ether 325 C.c.; Alcohol 675 C.c. (4 fl. oz. and 8¼ fl. oz.).

SPIRITUS ÆTHERIS COMPOSITUS, U. S.—Compound Spirit of Ether. (*Hoffmann's Anodyne.*)—Ether 325 C.c.; Alcohol 650 C.c.; ethereal oil 25 C.c.

Substitute usually sold for Hoffmann's Anodyne.—After the rectification of crude ether, an additional distillate is obtained, consisting of ether and alcohol, impregnated with a little ethereal oil. This is "*doctored*" to conform to the taste, smell, etc., of Hoffmann's Anodyne, and may be detected by mixing it with water, with which it forms a clear solution, instead of the milky solution characterizing the genuine article. *Castor oil* is sometimes added to circumvent this test, which may be detected by mixing equal parts with water, and collecting the separated oil on filtering paper; castor oil leaves a permanent, greasy stain, distinguishing it from ethereal oil.

Preparations of the Compound Ethers of the Ethyl and Amyl Series.

OLEUM ÆTHEREUM, U. S.—Ethereal Oil.—A volatile liquid, consisting of equal volumes of Heavy Oil of Wine and Stronger Ether, occurring as a transparent, nearly colorless, volatile liquid; of a peculiar, aromatic odor; a pungent, refreshing, bitterish taste; and a neutral reaction to dry litmus paper; sp. gr. 0.910. Made by distilling alcohol and sulphuric acid together at a temperature between 150° and 157° C. (302° and 314.6° F.), until the liquid ceases to come over, or until a black froth begins to rise in the retort; separating the yellow ethereal liquid and exposing it to the air for 24 hours, in a shallow capsule, transferring it to a wet filter, and washing with distilled water and draining, then adding an equal volume of stronger ether.

When alcohol is distilled with a large excess of sulphuric acid, there are produced heavy oil of wine, sulphurous acid, olefiant gas, and empyreumatic products. This occurs toward the close of the distillation, and the products generally separate into two layers, one consisting of water holding sulphurous acid in solution, and the other, of ether containing the heavy oil of wine. The heavy oil of wine is obtained by separating it from the other products, exposing for twenty-four hours, to dispel the ether, and washing with water, to free it from all traces of sulphurous acid.

The above refers to the products formed in the latter stages of distillation. In the earlier stage, ethyl-sulphuric acid, $C_2H_5HSO_4$, is formed, which, during the process, is decomposed, so as to yield ether. But if there is a large excess of sulphuric acid present, the ethyl sulphuric acid is decomposed, so as to form a small quantity of heavy oil of wine.

Ethereal oil is a mixture of compound ethers—ethyl sulphate $(C_2H_5)_2SO_4$, ethyl sulphite $(C_2H_5)_2SO_3$, with polymeric forms of ethylene, C_2H_4.

SPIRITUS ÆTHERIS NITROSI, U. S.—Spirit of Nitrous Ether. (*Sweet Spirit of Nitre.*)—A clear, mobile, volatile, and inflammable liquid, of a pale straw color, inclining slightly to green, and consisting of an alcoholic solution of ethyl nitrite, $C_2H_5NO_2$; 74.87. Fragrant, ethereal, pungent odor; free from acridity; sharp, burning taste; sp. gr. 0.836 to 0.848. Prepared by distilling a mixture of deodorized alcohol, sulphuric acid, and sodium nitrite together, using a well-cooled condenser, and a receiver surrounded by ice, connected air tight, and further connected with a small vial containing water, into which the connecting tube dips. The distillation is then washed first with ice-cold water to remove any alcohol which may have passed over, and then with ice-cold solution of sodium carbonate in distilled water to remove traces of acid, the ethereal layer separated and agitated with potassium carbonate to remove traces of water, and mixed with enough deodorized alcohol to make the mixture weigh 22 times the weight of the nitrous ether added.

In this process, ethyl nitrite is formed, and a compound ether is produced by substituting the acid radical NO_2 for the hydroxyl in the alcohol. This is then preserved from decomposition by adding sufficient alcohol.

Reactions for producing ethyl nitrite from alcohol:—

$$\underset{\text{Alcohol.}}{2C_2H_5OH} + \underset{\substack{\text{Sodium}\\\text{Nitrite.}}}{2NaNO_2} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{H_2SO_4} = \underset{\text{Ethyl Nitrite.}}{2C_2H_5NO_2} + \underset{\substack{\text{Sodium}\\\text{Sulphate.}}}{Na_2SO_4} + \underset{\text{Water.}}{2H_2O};$$

then,

$$\underset{\text{Alcohol.}}{C_2H_5(HO)} + \underset{\substack{\text{Nitrous}\\\text{Acid.}}}{HNO_2} = \underset{\substack{\text{Ethyl}\\\text{Nitrite.}}}{C_2H_5NO_2} + \underset{\text{Water.}}{H_2O}.$$

Pure Ethyl Nitrite is pale yellow; has the smell of apples; boils at 18° C. (64.4° F.); sp. gr. 0.900.

Sweet spirit of nitre is never entirely free from aldehyd; it is apt to contain a large amount of it if carelessly prepared. Aldehyd readily oxidizes to acetic acid, rendering the preparation sour.

ÆTHER ACETICUS, U. S.—Acetic Ether. (*Acetate of Ethyl.*) —A transparent and colorless liquid, with a strong, fragrant, ethereal, and somewhat acetous odor; burning, acetous taste and neutral reaction, containing about 98.5 per cent., by weight, of ethyl acetate ($C_2H_5C_2H_3O_2$; 87.8) and about 1.5 of alcohol containing a little water. Sp. gr. 0.893 to 0.895. Prepared by distilling sodium acetate, alcohol, and sulphuric acid together, shaking the distillate with exsiccated sodium acetate, and re-distilling it. It is a solution of ethyl acetate and a mixture of alcohol and water:—

$$\underset{\substack{\text{Sodium}\\\text{Acetate.}}}{NaC_2H_3O_2} + \underset{\substack{\text{Ethyl-sulphuric}\\\text{Acid.}}}{C_2H_5HSO_4} = \underset{\text{Ethyl Acetate.}}{C_2H_5C_2H_3O_2} + \underset{\substack{\text{Acid Sodium.}\\\text{Sulphate.}}}{NaHSO_4}.$$

AMYL NITRIS, U. S.—Amyl Nitrite.—A clear, pale-yellowish liquid; ethereal, fruity odor; pungent, aromatic taste; neutral or slightly acid reaction; containing about 80 per cent. of amyl (principally isoamyl) nitrite ($C_5H_{11}NO_2$; 116.78), together with variable quantities of undetermined compounds. Prepared by acting on amylic alcohol with nitric acid, by which the latter is deoxidized into nitrous acid, which acts on amylic alcohol as follows:—

$$\underset{\substack{\text{Amylic}\\\text{Alcohol.}}}{C_5H_{11}HO} + \underset{\substack{\text{Nitrous}\\\text{Acid.}}}{HNO_2} = \underset{\substack{\text{Amyl}\\\text{Nitrite.}}}{C_5H_{11}NO_2} + \underset{\text{Water.}}{H_2O}.$$

Aldehyd, its Derivatives and Preparations.

Aldehyd is a general term used to define a class of organic bodies. It has a more limited signification, however, as ordinarily used, and applies to ethyl aldehyd, which has a composition C_2H_4O, and is made by depriving alcohol, C_2H_6O, of two hydrogen atoms. This is effected by acting on alcohol with oxidizing agents.

PARALDEHYDUM, U. S.—Paraldehyde. $C_6H_{12}O_3$; 131.7.—A polymeric form of Ethylic Aldehyde (C_2H_4O; 43.9). A colorless, transparent liquid, having a strong, characteristic, but not unpleasant or pungent odor, and a burning and cooling taste. Soluble in 8.5 parts of water at 15° C. (59° F.), and in 16.5 parts of boiling water; miscible in all proportions with alcohol, ether, and fixed or volatile oils.

CHLORAL, U. S.—Chloral. $C_2HCl_3O.H_2O$; 164.97. (*Chloral Hydrate.*)—Chloral is aldehyd in which three atoms of hydrogen have been replaced by three atoms of chlorine. It occurs in separate, rhomboidal, colorless, and transparent crystals, slowly evaporating on exposure to air; aromatic, penetrating, and slightly acrid odor; a bitterish, caustic taste; neutral reaction. Prepared by passing dry chlorine gas, in a continuous stream, through absolute alcohol for six or eight weeks:—

$$\underset{\text{Alcohol.}}{C_2H_5.OH} + \underset{\text{Chlorine.}}{2Cl} = \underset{\text{Aldehyd.}}{CH_3.COH} + \underset{\substack{\text{Hydrochloric}\\ \text{Acid.}}}{2HCl};$$

then,

$$\underset{\text{Aldehyd.}}{CH_3COH} + \underset{\text{Chlorine.}}{6Cl} = \underset{\text{Chloral}}{CCl_3.COH} + \underset{\substack{\text{Hydrochloric}\\ \text{Acid.}}}{3HCl.}$$

CHLOROFORMUM, U. S.—Chloroform. $CHCl_3$; 119.08. (*Chloroformum Purificatum, Pharm. 1880.*)—A heavy, clear, colorless, mobile, and diffusible liquid, of a characteristic, ethereal odor, and a burning, sweet taste; sp. gr. not below 1.490 at 15° C. (59° F.), or 1.473 at 25° C. (77° F.); boiling at 60° to 61° C. (140° to 141.8° F.); consisting of 99 to 99.4 per cent. by weight of absolute chloroform, and 1 to 0.6 per cent. of alcohol; neutral reaction:—

$$\underset{\text{Alcohol.}}{C_2H_6O} + \underset{\substack{\text{Calcium}\\ \text{Hypochlorite.}}}{CaOCl_2} = \underset{\text{Aldehyd.}}{CH_3.COH} + \underset{\substack{\text{Calcium}\\ \text{Chloride.}}}{CaCl_2} + \underset{\text{Water.}}{H_2O};$$

then,

$$\underset{\text{Aldehyd.}}{2CH_3.COH} + \underset{\substack{\text{Calcium}\\ \text{Hypochlorite.}}}{6(CaOCl_2)} = \underset{\text{Chloral.}}{2CCl_3.COH} + \underset{\substack{\text{Calcium}\\ \text{Chloride.}}}{3CaCl_2} + \underset{\substack{\text{Calcium}\\ \text{Hydrate.}}}{3Ca(HO)_2};$$

then,

$$\underset{\text{Chloral.}}{2CCl_3.COH} + \underset{\substack{\text{Calcium}\\ \text{Hydrate.}}}{Ca(HO)_2} = \underset{\text{Chloroform.}}{(CHCl_3)_2} + \underset{\substack{\text{Calcium}\\ \text{Formate.}}}{Ca(CHO_2)_2.}$$

Chloroform can also be produced by substituting three atoms of chlorine for three hydrogen atoms of *methane*, marsh gas, CH_4. It is, therefore, chemically termed *trichlormethane.*

Purification of Chloroform.—Chloroform sometimes contains as an impurity, a chlorinated pyrogenous oil, from which it may be purified by treating with H_2SO_4 dried Na_2CO_3, and distilling with deodorized alcohol. The pyrogenous oil is decomposed by the H_2SO_4, and, in turn, blackened by it; the chloroform is separated from the H_2SO_4, agitated with solution of Na_2CO_3, to neutralize adhering acid, then mixed with alcohol, to preserve it from decomposition, and redistilled from lime, to separate water.

Official Preparations.—Aqua Chloroformi, Spiritus Chloroformi, Emulsum Chloroformi, Linimentum Chloroformi.

IODOFORMUM, U. S.—Iodoform. CHI_3; 392.56.—Small, lemon-yellow, lustrous crystals, of the hexagonal system; saffron-like and almost insuppressible odor; unpleasant, slightly sweetish, iodine-like taste; neutral reaction in solution. Made by heating alcohol, acid potassium carbonate, and iodine together, with water, and passing chlorine gas through the mixture, to cause the separation of iodoform, which may be filtered out, and purified by washing with distilled water and drying (Filhol's Process):—

$$\underset{\text{Alcohol.}}{C_2H_5HO} + \underset{\text{Iodine.}}{8I} + \underset{\substack{\text{Acid Potassium}\\\text{Carbonate.}}}{2KHCO_3} =$$

$$\underset{\substack{\text{Sodium}\\\text{Iodide.}}}{2KI} + \underset{\text{Iodoform.}}{2CHI_3} + \underset{\text{Water.}}{3H_2O} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{2CO_2}.$$

Official Preparation.—Unguentum Iodoformi.

Products of the Action of Ferments upon Acid Saccharine Fruits.

Important alcoholic liquids, which have received various names, according to the fruits from which they are derived, are formed by the action of ferment upon acid saccharine fruits.

Wine, from grapes; cider, from apples; perry, from pears, etc., occur by fermenting these fruits.

For a description of the official White and Red Wines see Vina, Part II.

The plant furnishing the grape is called *Vitis vinifera.* The juice of the fruit contains grape sugar, tannin, acid potassium tartrate, calcium tartrate, potassium sulphate, sodium chloride, pectin, albuminous principles, and water.

The aroma of wines depends upon the formation of certain compound ethers during the fermentation, and also during the ageing or ripening process.

Difference between Sweet and Dry Wine.—When the quantity of sugar in the juice is large, and the amount of ferment insufficient to convert it all into alcohol, *sweet* wine is produced. When the quantity of ferment is sufficient to convert all the sugar into alcohol, a strong, or generous, wine is formed. If only a moderate amount of sugar is present, with enough ferment to convert it all into alcohol, the wine is termed dry.

Sparkling Nature and Roughness.—Wine containing carbonic acid gas is called *sparkling;* when the gas is absent it is called *still.* When fermented with the seeds, it becomes rough and astringent, owing to the presence of tannic acid in the seeds.

ARGOL.—A precipitate of acid potassium tartrate, rendered impure by calcium tartrate, more or less coloring matter, and other matters deposited from the juice of the grape during fermentation and clarification. The precipitation is due to the fact that these matters, though soluble in grape juice, are insoluble in the dilute solution of alcohol formed by the fermentation.

SPIRITUS VINI GALLICI, U. S.—Brandy.—An alcoholic liquid obtained by the distillation of fermented grapes, and at least four years old. It should have a pale, amber color, a distinctive taste and odor, slightly *acid reaction,* and *sp.* gr. not above 0.941 nor below 0.925, corresponding, approximately, with an alcoholic strength of 39 to 47 per cent. by weight, or 46 to 55 per cent. by volume.

ACIDUM TARTARICUM, U. S.—Tartaric Acid. $H_2C_4H_4O_6$; 149.64.—Nearly or entirely colorless, transparent, monoclinic prisms, permanent in the air; odorless; purely acid taste; acid reaction. Prepared by saturating the excess of acid in acid potassium tartrate or cream of tartar (prepared from *argol*) with calcium carbonate, and decomposing the resulting insoluble calcium tartrate by sulphuric acid, which precipitates it in combination with the lime, as calcium sulphate, and liberates the tartaric acid. Only one-half the tartaric acid is thus obtained. The remainder may be procured by decomposing the neutral potassium tartrate remaining in the solution after the precipitation of the calcium tartrate, by calcium chloride in excess. This may be decomposed by sulphuric acid, together with the first portion:—

$$\underset{\substack{\text{Acid Potassium}\\ \text{Tartrate.}}}{2KHC_4H_4O_6} + \underset{\substack{\text{Calcium}\\ \text{Carbonate.}}}{CaCO_3} =$$

$$\underset{\substack{\text{Potassium}\\ \text{Tartrate.}}}{K_2C_4H_4O_6} + \underset{\substack{\text{Calcium}\\ \text{Tartrate.}}}{CaC_4H_4O_6} + \underset{\text{Water.}}{H_2O} + \underset{\substack{\text{Carbon}\\ \text{Dioxide.}}}{CO_2};$$

then,

$$\underset{\substack{\text{Potassium}\\ \text{Tartrate.}}}{K_2C_4H_4O_6} + \underset{\substack{\text{Calcium}\\ \text{Chloride.}}}{CaCl_2} = \underset{\substack{\text{Calcium}\\ \text{Tartrate.}}}{CaC_4H_4O_6} + \underset{\substack{\text{Potassium}\\ \text{Chloride.}}}{2KCl},$$

and

$$\underset{\substack{\text{Calcium}\\ \text{Tartrate.}}}{2CaC_4H_4O_6} + \underset{\substack{\text{Sulphuric}\\ \text{Acid.}}}{2H_2SO_4} = \underset{\substack{\text{Calcium}\\ \text{Sulphate.}}}{2CaSO_4} + \underset{\text{Tartaric Acid.}}{2H_2C_4H_4O_6}.$$

Official Preparation.—Pulvis Effervescens Compositus (Seidlitz Powder).

LIMONIS SUCCUS, U. S.—Lemon Juice.—A yellowish, slightly turbid, acid liquid, having a slight odor of lemon, due to the presence of a trace of the volatile oil of the rind, containing about 7 per cent. of citric acid, and consisting of the freshly-pressed juice of the ripe fruit of *Citrus Limonum*.

ACIDUM CITRICUM, U. S.—Citric Acid. $H_3C_6H_5O_7.H_2O$; 209.50.—Colorless, translucent, right-rhombic prisms, not deliquescent except in moist air; efflorescent in warm air; odorless; agreeable, acid taste; acid reaction. Obtained from the juice of limes and lemons, by saturating the boiling juice with calcium carbonate, and decomposing the resulting calcium citrate with sulphuric acid, concentrating, and crystallizing:—

$$\underset{\substack{\text{Citric Acid in}\\ \text{Lemon Juice.}}}{2H_3C_6H_5O_7} + \underset{\substack{\text{Calcium}\\ \text{Carbonate.}}}{3CaCO_3} = \underset{\text{Calcium Citrate.}}{Ca_32C_6H_5O_7} + \underset{\text{Water.}}{3H_2O} + \underset{\substack{\text{Carbon}\\ \text{Dioxide.}}}{3CO_2};$$

then,

$$\underset{\text{Calcium Citrate.}}{Ca_32C_6H_5O_7} + \underset{\substack{\text{Sulphuric}\\ \text{Acid.}}}{3H_2SO_4} = \underset{\text{Citric Acid.}}{2H_3C_6H_5O_7} + \underset{\substack{\text{Calcium}\\ \text{Sulphate.}}}{3CaSO_4}.$$

Official Preparation.—Syrupus Acidi Citrici.

TAMARINDUS, U. S.—Tamarind.—The preserved pulp of the fruit of *Tamarindus indica*, containing citric and tartaric acids and small quantities of malic acid. Used in preparing confection of senna.

RHUS GLABRA, U. S.—**Rhus Glabra.** (*Rhus Glabrum, Pharm. 1870. Sumach.*)—The fruit of *Rhus glabra*, containing malic acid, which exists in it as calcium and potassium malate.

Official Preparation.—Extractum Rhois Glabræ Fluidum.

Acid Saccharine Fruits Containing Pectinous Bodies.

PECTIN.—A peculiar principle existing in certain fruits, and formed by the action of two other principles, *pectase* and *pectose*, upon each other during the process of ripening.

The moderate action of heat and water upon the fruits causes the citric, tartaric, or malic acid therein contained to act on the pectose, softening it and converting it into pectin. The pectin is then acted upon by the ferment *pectase*, which causes it to gelatinize on cooling, through the production of pectosic acid. This explains the formation of fruit jellies.

Official Preparation.—Syrupus Rubi Idæi.

VOLATILE OILS.

Volatile or *essential* oils are odorous principles found in various parts of plants, pre-existing, or produced by the reaction of certain constituents when brought in contact with water; or sometimes formed through destructive distillation, as the oil of amber; or they may be obtained from the animal kingdom, as the oil from ambergris.

Four Classes into which Volatile Oils may be Divided.—1st. Terpenes, or hydrocarbons, consisting of C and H, mostly with the formula $C_{10}H_{16}$; type, oil of turpentine. 2d. Oxygenated oils, or hydrocarbons containing oxygen; type, oil of cinnamon. 3d. Sulphurated oils, containing sulphur; type, volatile oil of mustard. 4th. Nitrogenated oils, a small class, containing hydrocyanic acid; type, oil of bitter almond.

Two Proximate Principles of which Volatile Oils Consist.—*Stearopten* and *eleopten*, the former congealing at a lower temperature than the latter. Some of the stearoptens are called camphors.

Action of Light and Air on Volatile Oils.—The fragrance of the oil is destroyed, *ozone* is developed, and the oils thicken, resinify, or deposit crystalline compounds.

Action of Acids and Alkalies on Volatile Oils.—Strong nitric acid decomposes them with great rapidity; some oils react with iodine with explosive violence. Alkalies, with the exception of a few oils with which they form chemical compounds, have, generally, but little effect on volatile oils.

Principal Adulterations.—*Fixed oil;* detected by dropping the suspected oil on a piece of filtering paper; if a fixed oil is present, the stain will not evaporate on gently heating. *Alcohol;* detected by shaking in a graduated tube, with glycerin or water, which takes up the alcohol and decreases the volume of oil. Or if a large quantity of alcohol has been used, by setting fire to a small portion in a dish in a dark room, when the *lambent blue flame* of burning alcohol will be seen, in contrast to the yellow, sooty flame of volatile oil. Other tests are metallic sodium, calcium chloride, and aniline red. *Volatile oils, or cheaper grades* of the *same* oil, or a *cheaper oil having a similar odor;* test, by the olfactories.

Preparation.—Volatile oils are usually prepared from plants, and generally, either by distillation with water, distillation *per se*, expression, or solution.

1. *Distillation with Water.*—Put the substance from which the oil is to be extracted into a still, and add enough water to cover it; then distill, by a regulated heat, into a large refrigeratory. Separate the distilled oil from the water which comes over with it.

2. *Distillation per se.*—Distillation "by itself," or without the use of water. Ex.—Certain oleoresins, copaiba, etc.

3. *Expression.*—The volatile oil of orange will illustrate this process. The advantage is, that heat is not employed; but the disadvantage is, that expressed oils have a small portion of albumen, which renders them turbid.

4. *Solution or Absorption.*—This operation is effected by maceration, digestion, percolation with carbon bisulphide or similar solvent, enfleurage, or the pneumatic process. Used in cases where the oils are so delicate that they are decomposed by distillation, and exist in such small proportion in the plant that it does not pay to express them.

Maceration.—This is accomplished by allowing the odorous portion of a plant to stand in contact with a bland, inodorous, fixed oil. The oil absorbs the odor, and, after a certain length of time, it is strained. The odorous fixed oil is generally used in perfumes.

Digestion.—Similar to maceration, except moderate heat is employed.

Enfleurage.—A cold process, and much used for delicate flowers; conducted by sprinkling the flowers on thin layers of purified, inodorous fat spread on glass. The glasses are fixed in frames resembling window-sashes. The frames are piled in a stack, and left undisturbed for twelve hours or three or four days.

When strong pomade is desired, fresh flowers are added from time to time, as long as absorption continues, and the pomades are known commercially as Nos. 6, 12, 18, and 24, which indicate their strength. When the volatile oils are desired, they are extracted from the pomade by macerating the latter, in a finely chopped condition, in pure alcohol; afterward separating the small amount of fatty matter dissolved by the alcohol, by refrigerating and filtering.

Pneumatic Process.—Used only with very delicate volatile oils. It consists in forcing a current of air through a vessel filled with fresh flowers, into another vessel containing melted purified fat, with revolving circular plates half immersed therein. These circular plates become coated with fat, and absorb the odor from the perfumed air.

Percolation.—Odorous flowers are percolated with purified carbon disulphide. The latter is distilled, thus separating it from the volatile oil.

Official Products from the Aurantiaceæ.

AURANTII DULCIS CORTEX, U. S.—Sweet C

Official Preparations.—Syrupus Aurantii, Tinctura Aur

AURANTII AMARI CORTEX, U. S.—Bitter C

Official Preparations.—Extractum Aurantii Amari Fluidum, Tinctura Aurantii Amari.

OLEUM AURANTII CORTICIS, U. S.—Oil of Orange Peel.

Official Preparations.—Spiritus Aurantii, Spiritus Aurantii Compositus.

OLEUM AURANTII FLORUM.—Oil of Orange Flowers.—An inferior sort of oil, *essence de petit grain*, is made by distilling the leaves and unripe fruit.

LIMONIS CORTEX, U. S.—Lemon Peel.

OLEUM LIMONIS, U. S.—Oil of Lemon.

Official Preparation.—Spiritus Limonis.

OLEUM BERGAMOTTÆ, U. S.—Oil of Bergamot. (*Oil of Bergamia, Pharm. 1880.*)

Official Products from the Labiatæ.

MENTHA PIPERITA, U. S.—Peppermint.

OLEUM MENTHÆ PIPERITÆ, U. S.—Oil of Peppermint.

Official Preparations.—Aqua Menthæ Piperitæ, Spiritus Menthæ Piperitæ, Trochisci Menthæ Piperitæ.

MENTHA VIRIDIS, U. S.—Spearmint.

OLEUM MENTHÆ VIRIDIS, U. S.—Oil of Spearmint.

Official Preparations.—Aqua Menthæ Viridis, Spiritus Menthæ Viridis.

MENTHOL, U. S.—Menthol. $C_{10}H_{19}OH$; 155.66.—A stearopten (having the character of a secondary alcohol), obtained from the official oil of peppermint, or from Japanese or Chinese oil of peppermint; colorless, acicular, or prismatic crystals, having a strong and pure odor of peppermint, and a warm, aromatic taste, followed by a sensation of cold when air is drawn into the mouth. Menthol is only slightly soluble in water, but imparts to the latter its odor and taste. It is freely soluble in alcohol, ether, chloroform, carbon disulphide, or glacial acetic acid.

OLEUM LAVANDULÆ FLORUM, U. S.—Oil of Lavender Flowers.

Official Preparations.—Tinctura Lavandulæ Composita, Spiritus Lavandulæ.

OLEUM ROSMARINI, U. S.—Oil of Rosemary.

HEDEOMA, U. S.—Hedeoma. (*Pennyroyal.*)

OLEUM HEDEOMÆ, U. S.—Oil of Hedeoma. (*Oil of Pennyroyal.*)

MARRUBIUM, U. S.—Marrubium. (*Horehound.*)—The leaves and tops of *Marrubium vulgare* contain a volatile oil associated with resin, and a bitter principle, *Marrubiin.*

MELISSA, U. S.—Melissa. (*Balm.*)—The leaves and tops of *Melissa officinalis* contain an oxygenated volatile oil.

OLEUM THYMI, U. S.—Oil of Thyme.

THYMOL, U. S.—Thymol. $C_{10}H_{14}O$; 149.66.—A phenol occurring in the volatile oil of *Thymus vulgaris*, *Monarda punctata*, and *Carum ajowan*; occurring in light, colorless, translucent crystals of the hexagonal system; aromatic, thyme-like odor; pungent; aromatic taste with a very slight caustic effect upon the lips; neutral reaction. Soluble in 1200 parts water, and less than its own weight of alcohol.

SALVIA, U. S.—Salvia. (*Sage*).—The leaves of *Salvia officinalis* contain a volatile oil, which consists of a terpene, $C_{10}H_{16}$, and an oxygenated portion, *salviol*, $C_{10}H_{18}O$.

SCUTELLARIA, U. S.—Scutellaria. (*Scullcap.*)—*Scutellaria lateriflora* contains volatile oil, tannin, and a bitter principle.

Official Preparation.—Extractum Scutellariæ Fluidum.

Official Products of the Aromatic Umbelliferæ.

CARUM, U. S.—Caraway.

OLEUM CARI, U. S.—Oil of Caraway.

FŒNICULUM, U. S.—Fennel.

OLEUM FŒNICULI, U. S.—Oil of Fennel.

Official Preparation.—Aqua Fœniculi.

CORIANDRUM, U. S.—Coriander.—The fruit of *Coriandrum sativum* furnishes about 1 per cent. of an agreeable, aromatic oil, also about 10 per cent. of fixed oil.

OLEUM CORIANDRI, U. S.—Oil of Coriander.

SUMBUL, U. S.—Sumbul.—The root of *Ferula Sumbul* contains about ½ per cent. of volatile oil and about 10 per cent. of a resinous compound having a musky odor.

Official Preparation.—Tinctura Sumbul.

ANISUM, U. S.—Anise.

OLEUM ANISI, U. S.—Oil of Anise.—A volatile oil distilled from anise or from illicium. At 10° to 15° C. (50° to 59° F.) it solidifies to a crystalline mass, which does not resume its fluidity until the temperature rises to about 17° C. (62.6° F.). *Oil of Illicium* (*Star-anise*) has nearly the same properties, except that it congeals at about 2° C. (35.6° F.). It consists of a small quantity of hydrocarbon, $C_{10}H_{16}$, but mainly of *anethol*, $C_{10}H_{12}O$, which is present in two modifications—one, solid at ordinary temperatures and heavier than water (*anise camphor*, *solid anethol*), the other liquid and more volatile (*liquid anethol*). *Anethol*, both in the liquid and in the solid form, is present, and is the chief constituent of the oils of *anise*, *star-anise*, and *fennel*.

Official Preparations.—Aqua Anisi, Spiritus Anisi.

ILLICIUM, U. S.—Star-Anise.

Official Aromatic Products, with their Volatile Oils.

CINNAMOMUM CASSIA, U. S.—Cassia Cinnamon. (*Cinnamomum, Pharm. 1880. Cassia Bark.*)—The bark of the shoots of one or more undetermined species of *Cinnamomum* grown in China (Chinese Cinnamon).

CINNAMOMUM SAIGONICUM, U. S.—The bark of an undetermined species of Cinnamon.

CINNAMOMUM ZEYLANICUM, U. S.—Ceylon Cinnamon.

(*Cinnamomum, Pharm. 1880.*)—The inner bark of the shoots of *Cinnamomum zeylanicum.*

Official Preparation.—Tinctura Cinnamomum.

OLEUM BETULÆ VOLATILE, U. S.—Volatile Oil of Betula. (*Oil of Sweet Birch.*)—A volatile oil obtained by distillation from the bark of *Betula lenta.* It is identical with Methyl Salicylate, $CH_3C_7H_5O_3$, and nearly identical with Oil of Gaultheria.

OLEUM CINNAMOMI, U. S.—Oil of Cinnamon, Oil of Cassia.—A volatile oil distilled from Cassia Cinnamon.

There is no essential difference between the oil of Ceylon cinnamon and oil of cassia, except the latter is much the cheaper and more abundant of the two.

Oil of Ceylon Cinnamon has a slightly acid reaction; sp. gr. about 1.040. When cooled to — 10° C. (14°F.) it remains clear, but at a lower temperature a solid portion separates from it. *Oil of Chinese Cinnamon* (Oil of Cassia) has the same properties, except that its specific gravity is about 1.060, and its odor and taste are not quite so agreeable.

Oil of cinnamon consists of *cinnamic aldehyd*, C_9H_8O, which, by moderate oxidation, yields the corresponding cinnamic acid $C_9H_8O_2$, but, by more energetic oxidation, yields benzoic acid, $C_7H_6O_2$.

Oil of Ceylon cinnamon, when it is not very fresh, contains cinnamic acid in sufficient quantity to give a permanent cloudiness to cinnamon water made from it.

Official Preparations.—Aqua Cinnamomi, Spiritus Cinnamomi.

CARYOPHYLLUS, U. S.—Cloves.

OLEUM CARYOPHYLLI, U. S.—Oil of Cloves.

PIMENTA, U. S.—Pimenta. (*Allspice.*)

OLEUM PIMENTÆ, U. S.—Oil of Pimenta. (*Oil of Allspice.*)

OLEUM MYRCIÆ, U. S.—Oil of Myrcia. (*Oil of Bay.*)

Official Preparation.—Spiritus Myrciæ, (Bay Rum).

VANILLA, U. S.—Vanilla.—Contains a trace of a volatile oil, 10 per cent. of fixed oil, resin, sugar, etc., and *vanillin*, $C_8H_8O_3$.

Official Preparation.—Tinctura Vanillæ.

OLEUM CAJUPUTI, U. S.—Oil of Cajuput.

EUCALYPTUS, U. S.—Eucalyptus.—The leaves of *Eucalyptus globulus*, collected from rather old trees, contain a volatile oil, resin, tannin, chlorophyl, fatty acid, etc.

Official Preparation.—Extractum Eucalypti Fluidum.

EUCALYPTOL, U. S.—Eucalyptol. $C_{10}H_{18}O$; 153.66.—A neutral body obtained from the volatile oil of *Eucalyptus globulus*, and of some other species of *Eucalyptus.* A colorless liquid, having a characteristic, aromatic, and distinctly camphoraceous odor, and a pungent, spicy, and cooling taste.

OLEUM EUCALYPTI, U. S.—Oil of Eucalyptus.

MYRISTICA, U. S.—Nutmeg.

***OLEUM* MYRISTICÆ, U. S.—Oil of Nutmeg.**

Expressed oil of nutmeg, or *oil of mace*, is a fixed oil, made by ing nutmegs between hot plates, or macerating them in carbon disulphide and distilling.

Official Preparation.—Spiritus Myristicæ.

MACIS, U. S.—Mace.—The arillus of the fruit of *Myristica fragrans* contains about 70 per cent. of a light, volatile oil, chiefly a terpene $C_{10}H_{16}$ (macene), and a fixed oil.

CASCARILLA, U. S.—Cascarilla.—The bark of *Croton Eluteria*, Bennett, contains about 2 per cent. of an oxygenated volatile oil, a crystalline principle, *cascarillin*, $C_{12}H_{18}O_4$, 15 per cent. of resin, also tannin, gum, pectin, etc.

SASSAFRAS, U. S.—Sassafras.

OLEUM SASSAFRAS, U. S.—Oil of Sassafras.

METHYL SALICYLAS, U. S.—Methyl Salicylate. $CH_3C_7H_5O_3$; 151.64. (*Artificial* (*or Synthetic*) *Oil of Wintergreen.*)—Methyl salicylate produced synthetically. A colorless or slightly yellowish liquid, having the characteristic, strongly aromatic odor and the sweetish, warm, and aromatic taste of Oil of Gaultheria, with the essential constituents of which it is identical. It is wholly identical with Volatile Oil of Betula. (See *Oleum Betulæ Volatile.*)

OLEUM GAULTHERIÆ, U. S.—Oil of Gaultheria. (*Oil of Wintergreen.*)—It is the heaviest of all the volatile oils, having the sp. gr. 1.180. It is a colorless or yellow or reddish liquid; of a peculiar, strong, and aromatic odor; a sweetish, warm, and aromatic taste, and a slightly acid reaction; sp. gr. about 1.180. The reddish color is due to a trace of iron. Oil of Wintergreen is nearly identical with Volatile Oil of Betula.

Official Preparation.—Spiritus Gaultheriæ.

CALAMUS, U. S.—Calamus. (*Sweet Flag.*)—The rhizome of *Acorus calamus* contains a volatile oil, having the composition of a terpene, $C_{10}H_{16}$, soft resin, a bitter principle, acorin, starch, and mucilage.

Official Preparation.—Extractum Calami Fluidum.

CARDAMOMUM, U. S.—Cardamom.—The fruit of *Elettaria repens* contains 5 per cent. of an oxygenated volatile oil, of the sp. gr. 0.943, 10 per cent. of fixed oil, starch, mucilage, etc.

Official Preparations.—Tinctura Cardamomi, Tinctura Cardamomi Composita.

ZINGIBER, U. S.—Ginger.—The rhizome of *Zingiber officinale* owes its virtues to about 4 per cent. of volatile oil (terpene), having the composition $C_{10}H_{16}$, and a soft, pungent, aromatic resin, which is soluble in alcohol and ether.

Official Preparations.—Extractum Zingiberis Fluidum, Oleoresina Zingiberis, Syrupus Zingiberis, Tinctura Zingiberis, Trochisci Zingiberis.

Stearoptens from Volatile Oils.

CAMPHORA, U. S.—Camphor. $C_{10}H_{16}O$; 151.66.—A stearopten (having the nature of a ketone) derived from *Cinnamomum Camphora*, and purified by sublimation. It occurs in white, translucent masses, of a tough consistence and crystalline structure; readily pulverizable in the presence of a little alcohol, ether, or chloroform.

Official Preparations.—Aqua Camphoræ, Ceratum Camphoræ, Linimentum Camphoræ, Spiritus Camphoræ.

CAMPHORA MONOBROMATA, U. S.—Monobromated Camphor. $C_{10}H_{15}BrO$; 230.42.—Colorless, prismatic needles or scales, permanent in the air, and unaffected by light; mild, camphoraceous odor and taste; neutral reaction. Made by heating camphor and bromine together, cooling, dissolving the crystalline mass in petroleum benzine, and recrystallizing.

Official Substances Containing Nitrogenated and Sulphurated Oils, with Allied Products.

AMYGDALA AMARA, U. S.—Bitter Almond.—The seed of *Amygdalus communis*, var. *amara*, containing a glucoside called *amygdalin*, which splits into benzyl-aldehyd, or oil of bitter almond, hydrocyanic acid and glucose, under the influence of emulsin, or synaptase, a ferment, which becomes active in the presence of water:—

$$\underset{\substack{\text{Crystallized}\\\text{Amygdalin.}}}{C_{20}H_{27}NO_{11}} + \underset{\text{Water.}}{3H_2O} =$$

$$\underset{\text{Dextro-glucose.}}{2(C_6H_{12}O_6)} + \underset{\substack{\text{Hydrocyanic}\\\text{Acid.}}}{HCN} + \underset{\substack{\text{Oil of}\\\text{Bitter Almond.}}}{C_7H_6O} + \underset{\text{Water.}}{H_2O.}$$

OLEUM AMYGDALÆ AMARÆ, U. S.—Oil of Bitter Almonds.—A colorless or yellowish, thin, volatile oil, with a peculiar, aromatic odor; bitter and a burning taste; neutral reaction. Obtained from bitter almond by maceration with water and subsequent distillation.

Preparation.—The bitter almond cake obtained after extracting the fixed oil is mixed with water, and distilled by passing a current of steam through it. The emulsin reacts on the amygdalin in presence of the aqueous vapor, and oil of bitter almond, or benzyl aldehyd, is produced:—

$$\underset{\text{Amygdalin.}}{C_{20}H_{27}NO_{11}} + \underset{\text{Water.}}{2H_2O} = \underset{\substack{\text{Benzyl-}\\\text{Aldehyd.}}}{C_7H_6O} + \underset{\text{Glucose.}}{2C_6H_{12}O_6} + \underset{\substack{\text{Hydrocyanic}\\\text{Acid.}}}{HCN.}$$

As sweet almond does not contain amygdalin, oil of bitter almond cannot be prepared from it.

Artificial benzyl-aldehyd is made by the action of chlorine upon hot toluol, C_7H_8. Benzyl-chloride, $C_6H_5CH_2Cl$, results, and this yields benzyl-aldehyd on distillation with lead nitrate and water, in an atmosphere of CO_2. It is identical with oil of bitter almond.

Oil of Myrbane, or nitro-benzol, is an entirely different product, made by reacting on benzol with nitric acid. Its odor is similar to, but not identical with, oil of bitter almond. It is used for perfuming soaps.

Official Preparation.—Aqua Amygdalæ Amaræ.

PRUNUS VIRGINIANA, U. S.—Wild Cherry.—The bark of *Prunus serotina*, collected in autumn, contains amygdalin, emulsin, tannin, bitter principle, starch, etc., and furnishes the same reaction wi
with the production of oil of bitter almond and hydrocyanic aci
almond.

Official Preparations.—Infusum Pruni Virginianæ, Syrupı
ginianæ, Extractum Pruni Virginianæ Fluidum.

ACIDUM HYDROCYANICUM DILUTUM, U. S.—Diluted Hydrocyanic Acid. (*Prussic Acid.*)—A colorless liquid, of a characteristic odor and taste, resembling bitter almonds; slight acid reaction; composed of 2 per cent. absolute hydrocyanic acid (HCN; 26.98) and 98 per cent. of alcohol and water. Made by distilling together potassium ferrocyanide, diluted alcohol, and sulphuric acid, and diluting to the proper strength with distilled water:—

$$\underset{\substack{\text{Potassium}\\\text{Ferrocyanide.}}}{2K_4FeC_6N_6} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{3H_2SO_4} =$$

$$\underset{\substack{\text{Potassium}\\\text{Ferrous}\\\text{Ferrocyanide.}\\\text{(Everitt's Salt.)}}}{K_2Fe_2C_6N_6} + \underset{\substack{\text{Potassium}\\\text{Acid Sulphate}}}{3K_2SO_4} + \underset{\substack{\text{Hydrocyanic}\\\text{Acid.}}}{6HCN.}$$

Scheele's Hydrocyanic Acid is a stronger solution, containing about 5 per cent. anhydrous acid.

SINAPIS ALBA, U. S.—White Mustard.—The seed of *Sinapis alba* Linné "contains *sinalbin*, $C_{30}H_{44}N_2O_{16}S_2$, a crystalline glucoside, which, under the influence of a peculiar ferment, *myrosin*, and water, is split into *acrinyl thiocyanate*, C_8H_7NOS, which is a pungent, volatile oil (this is not the official oil of mustard), *sinapine sulphate*, $C_{16}H_{23}NO_5\text{-}H_2SO_4$, and glucose. The seed contains, in addition, 20 per cent. of fixed oil, mucilage, gum, etc., but no starch."—(Remington.)

SINAPIS NIGRA, U. S.—Black Mustard.—The seed of *Sinapis nigra* "contains potassium myronate ($KC_{10}H_{18}NS_2O_{10}$), *myrosin*, a ferment, 25 per cent. of fixed oil, mucilage, etc. Under the influence of the myrosin and water, the potassium myronate is converted into allyl isothiocyanate, or volatile oil of mustard. This action takes place at ordinary temperatures, and explains the pungency of aqueous mixtures of ground mustard."—(Remington.)

Official Preparation.—Charta Sinapis—Mustard Paper.

OLEUM SINAPIS VOLATILE, U. S.—Volatile oil of Mustard.—A volatile oil obtained from black mustard by maceration with water, and subsequent distillation.

Chemically, this oil is *allyl iso-thiocyanate;* it is also called *sulphocyanide of allyl.* It is prepared artificially by distilling *allyl sulphate* with *potassium thiocyanate.* It is a colorless or pale-yellow liquid, having a very pungent and acrid odor and taste, and a neutral reaction; sp. gr. 1.017 to 1.021.

Official Preparation.—Linimentum Sinapis Compositum.

ALLIUM, U. S.—Garlic.—The bulb of *Allium sativum* contains a volatile sulphurated oil known as allyl sulphide $(C_3H_5)_2S$, mucilage, albumin, etc.

Official Preparation.—Syrupus Allii.

OFFICIAL DRUGS AND PRODUCTS CONTAINING VOLATILE OIL WITH SOFT RESIN.

PIPER, U. S.—Pepper. (*Black Pepper.*)—The unripe fruit of *Piper nigrum* contains piperine, a feeble alkaloid, 2 per cent. volatile oil (a terpene $C_{10}H_{16}$), a pungent resin.

Official Preparation.—Oleoresinæ Piperis.

PIPERINUM U. S.—Piperin. $C_{17}H_{19}NO_3$; 284.38.—A neutral principle, obtained from pepper, and also obtainable in other plants of the Nat. Ord. *Piperaceæ.*

Description.—Colorless or pale-yellowish, shining, four-sided prisms, permanent in the air; odorless; almost tasteless when first put in the mouth, but, on prolonged contact, producing a sharp and biting sensation; neutral reaction.

Preparation.—Pepper is treated with alcohol; the tincture evaporated to an extract; the extract treated with an alkaline solution, to saponify oleaginous matter; the undissolved portion washed with cold water; filtered; the matter left on the filter treated with alcohol, the resulting solution evaporated spontaneously or by gentle heat. Crystals of piperin are deposited and purified by alternate solution in alcohol or ether, and crystallizing.

Piperin is decomposed by alkalies in alcoholic solution into *piperic acid*, $C_{12}H_{10}O_4$, and *piperidine*, $C_5H_{11}N$.

MATICO, U. S.—Matico.—The leaves of *Piper angustifolium* contain about 2 per cent. of volatile oil, a pungent resin, a crystalline principle, *artanthic acid*, and tannin.

Official Preparations.—Extractum Matico Fluidum, Tinctura Matico.

CUBEBA, U. S.—Cubeb.—The unripe fruit of *Piper cubeba* contains about 10 per cent. of volatile oil, 3 per cent. of resin, cubebin, *cubebic acid*, wax, fat, etc.

Official Preparations.—Extractum Cubebæ Fluidum, Oleoresina Cubebæ, Trochisci Cubebæ, Tinctura Cubebæ.

OLEUM CUBEBÆ, U. S.—Oil of Cubeb.

CAPSICUM, U. S.—Capsicum. (*Cayenne Pepper. African Pepper.*)—The fruit of *Capsicum fastigiatum*, containing capsaicin, $C_9H_{14}O_2$, traces of a volatile alkaloid and a volatile oil, fixed oil, resin, coloring matter, etc. *Capsaicin* is in colorless crystals, volatile, intensely acrid, and soluble in alcohol, ether, and fixed oils.

Official Preparations.—Emplastrum Capsici, Extractum Capsici Fluidum, Oleoresina Capsici, Tinctura Capsici.

COPAIBA, U. S.—Copaiba. (*Balsam of Copaiba.*)—The oleoresin of *Copaiba Langsdorffii* and of other species of *Copaifera* contains *copaivic acid*, volatile oil, and a bitter principle. Copaivic acid, $C_{20}H_{30}O_2$, the resinous mass left after distilling the oil, forms a series of amorphous salts.

Description.—A transparent or translucent, more or less viscid liquid, of a color varying from pale yellow to brownish yellow; sp. gr. 0.940 to 0.993; peculiar aromatic odor; persistently bitter and acrid taste.

Official Preparations.—Massa Copaibæ, Resina Copaibæ.

OLEUM COPAIBÆ, U. S.—Oil of Copaiba.

OLEUM SANTALI, U. S.—Oil of Santal. (*Oil of Sandal Wood.*)

BUCHU, U. S.—Buchu.—The leaves of *Barosma betulina*, and *Barosma crenulata*, contain a volatile oil and resin, a bitter principle, mucilage, etc. The stearopten *diosphenol* is colored dark green by ferric chloride.

Official Preparation.—Extractum Buchu Fluidum.

SERPENTARIA, U. S.—Serpentaria. (*Virginia Snakeroot.*)—The rhizome and rootlets of *Aristolochia serpentaria* Linné and of *Aristolochia reticulata* Nuttall, contain 1 per cent. of volatile oil, a bitter principle, starch, sugar, etc.

Official Preparations.—Extractum Serpentariæ Fluidum, Tinctura Serpentariæ.

HUMULUS, U. S.—Hops.—The strobiles of *Humulus Lupulus* contain a small quantity of volatile oil; their bitterness is due to the resin and lupulin present.

Official Preparation.—Tinctura Humuli.

LUPULINUM, U. S.—Lupulin. (*Lupulina, Pharm. 1870.*)—The glandular powder separated from the strobiles of *Humulus Lupulus* contains 10 per cent. of volatile oil, which, on exposure, yields valerianic acid, trimethylamine, a bitter principle (lupamaric acid), $C_{82}H_{50}O_7$, resin, wax, and an alkaline liquid termed *lupuline.*

Official Preparations.—Extractum Lupulinæ Fluidum, Oleoresina Lupulini.

CANNABIS INDICA, U. S.—Indian Cannabis. (*Indian Hemp.*)—The flowering tops of the female plant of *Cannabis sativa*, grown in the East Indies, contain a resinous substance, *cannabinine*, volatile oil, and tetano-cannabinine.

Official Preparations.—Extractum Cannabis Indicæ, Extractum Cannabis Indicæ Fluidum, Tinctura Cannabis Indicæ.

VALERIANA, U. S.—Valerian.—The rhizome and rootlets of *Valeriana officinalis* contain about 1 per cent. of volatile oil, valerianic acid, resin, starch, tannin, etc.; there are also present some acetic and formic acids.

Official Preparations.—Extractum Valerianæ Fluidum, Tinctura Valerianæ, Tinctura Valerianæ Ammoniata.

VIBURNUM OPULUS, U. S.—Viburnum Opulus. (*Cramp Bark.*)—The bark of Viburnum Opulus.

VIBURNUM PRUNIFOLIUM, U. S.—Black Haw.—(*Viburnum, Pharm. 1880.*)—The bark of *Viburnum prunifolium* contains valerianic acid, a bitter, resinous principle, *viburnin*, tannin, sugar, etc.

Official Preparation.—Extractum Viburni Prunifolium Fluidum.

SAMBUCUS, U. S.—Sambucus. (*Elder.*)—The flow
bucis canadensis contain a little volatile oil and resin, su

CHENOPODIUM, U. S.—Chenopodium. (*A*
—The fruit of *Chenopodium ambrosioides*, variety *ant*
a volatile oil, a small quantity of resin, and a bitter

OLEUM CHENOPODII, U. S.—Oil of Ch
American Wormseed.)

OLEUM JUNIPERI, U. S.—Oil of Juniper.

Official Preparations.—Spiritus Juniperi, Spiritus Juniperi Compositus.

SABINA, U. S.—Savine.—The tops of *Juniperus Sabina* contain a terpene $C_{10}H_{16}$, and resin, with a trace of tannin.

Official Preparation.—Extractum Sabinæ Fluidum.

OLEUM SABINÆ, U. S.—Oil of Savine.

Official Drugs and Products containing Volatile Oil Associated with Bitter Principle or Extractive.

ABSINTHIUM, U. S.—Absinthium. (*Wormwood.*)—The leaves and tops of *Artemisia Absinthium* contain 1 per cent. of an oxygenated volatile oil, which is chiefly absinthol, $C_{10}H_{16}O$. The bitter principle is *absinthin*, $C_{40}H_{58}O_9$. It also contains tannin, resin, and succinic acid.

TANACETUM, U. S.—Tansy.—The leaves and tops of *Tanacetum vulgare* contain a small quantity of volatile oil, which is freely soluble in alcohol. The bitter principle is *tanacetin.* It also contains tannin, fat, resin, etc.

ARNICÆ FLORES, U. S.—Arnica Flowers.—The flower heads of *Arnica montana* contain a trace of volatile oil, and a bitter principle, *arnicin*, with resin, coloring matter, etc.

Official Preparation.—Tinctura Arnicæ Florum.

ARNICÆ RADIX, U. S.—Arnica Root.—The rhizome and rootlets of *Arnica montana* contain about 1 per cent. of volatile oil, the bitter principle *arnicin*, acrid resin, tannin, etc.

Official Preparations.—Extractum Arnicæ Radicis, Emplastrum Arnicæ, Extractum Arnicæ Radicis Fluidum, Tinctura Arnicæ Radicis.

CALENDULA, U. S.—Calendula. (*Marigold.*)—The florets of *Calendula officinalis* contain a small quantity of a volatile oil, a bitter principle, gum, sugar, etc. *Calendulin* is not the active principle, having very little taste.

Official Preparation.—Tinctura Calendulæ.

OLEUM ERIGERONTIS, U. S.—Oil of Erigeron. (*Oil of Fleabane.*)

INULA, U. S.—Inula. (*Elecampane.*)—The root of *Inula Helenium* contains acrid resin and a volatile oil, which are the active principles. Helenin, C_6H_8O, is inert. *Inulin*, a kind of starch, is abundant.

ANTHEMIS, U. S.—Anthemis. (*Chamomile.*)—The flower-heads of *Anthemis nobilis*, collected from cultivated plants, contain a volatile oil and a bitter principle, which has been called *anthemic acid.*

MATRICARIA, U. S.—Matricaria. (*German Chamomile.*)—The flower-heads of *Matricaria Chamomilla* contain a dark-blue volatile oil; the bitter principle is termed *anthemic acid.*

EUPATORIUM, U. S.—Eupatorium. (*Thoroughwort, Boneset.*)—The leaves and flowering tops of *Eupatorium perfoliatum* contain a volatile oil and resin, *eupatorin*, gum, tannin, sugar, etc.

Official Preparation.—Extractum Eupatorii Fluidum.

GRINDELIA, U. S.—Grindelia.—The leaves and flower *Grindelia robusta* contain a volatile oil and a bitter and resin

Official Preparation.—Extractum Grindeliæ Fluidum.

ERIODICTYON, U. S.—Eriodictyon.—The leaves of *Eriodictyon glutinosum*, known as *Yerba Santa*, or *mountain balm*, contain a bitter resin, volatile oil, and extractive.

Official Preparation.—Extractum Eriodictyi Fluidum.

MEZEREUM, U. S.—Mezereum.—The bark of *Daphne Mezereum* and other species of *Daphne* contains *daphnin*, $C_{31}H_{34}O_{19}$, a glucoside, associated with an acrid, soft resin, and oil.

Official Preparation.—Extractum Mezerei Fluidum.

ASPIDIUM, U. S.—Aspidium. (*Male Fern.*)—The rhizome of *Dryopteris Filix-mas*, Schott, and of *Dryopteris marginalis*, Asa Gray, contains *filicic acid*, $C_{14}H_{18}O_5$, filix red, filitannic acid, fixed oil, etc.

Official Preparation.—Oleoresina Aspidii.

CYPRIPEDIUM, U. S.—Cypripedium. (*Lady's Slipper.*)—The rhizome and rootlets of *Cypripedium pubescens*, Wildenow, and of *Cypripedium parviflorum*, Salisbury, contain resins, an acrid principle, volatile oil, tannin, starch, etc.

Official Preparation.—Extractum Cypripedii Fluidum.

PHYTOLACCÆ RADIX, U. S.—Phytolacca Root. (*Poke Root.*) —The root of *Phytolacca decandra* contains an acrid resin, tannin, mucilage, etc.

Official Preparation.—Extractum Phytolaccæ Radicis Fluidum.

PHYTOLACCÆ FRUCTUS, U. S.—Phytolacca Fruit. (*Poke Berry.*)—The fruit of *Phytolacca decandra* contains reddish-purple coloring-matter, sugar, gum, etc.

ZEA, U. S.—Zea. (*Corn Silk.*)—The styles and stigmas of Zea Mays contain, when dried, maizenic acid, fixed oil, resin, etc.

STILLINGIA, U. S.—Stillingia. (*Queen's Root.*)—The root of *Stillingia sylvatica* contains an acrid resin, starch, fixed oil, gum, etc.

Official Preparation.—Extractum Stillingiæ Fluidum.

PYRETHRUM, U. S.—Pyrethrum. (*Pellitory.*)—The root of *Anacyclus Pyrethrum* contains an acrid, brown resin, and fixed oils, inulin, mucilage, etc.

Official Preparation.—Tinctura Pyrethri.

XANTHOXYLUM, U. S.—Xanthoxylum. (*Prickly Ash.*)—The bark of *Xanthoxylum Americanum*, Willdenow, and of *Xanthoxylum Clava-Herculis*, Lambert, contains a soft resin, a crystalline resin, a bitter principle, and an acrid, green oil.

Official Preparation.—Extractum Xanthoxyli Fluidum.

IRIS, U. S.—Iris. (*Blue Flag.*)—The rhizome and rootlets of *Iris versicolor* contain a bitter resin. There are also present sugar, gum, tannin, and fatty matter.

Official Preparations.—Extractum Iridis Fluidum, Extractum Iridis.

U. S.—Cimicifuga. (*Black Snakeroot.*)—The rhi-
fuga racemosa contain resin, an acrid principle
nnin, gum, etc.
n Cimicifugæ, Extractum Cimicifugæ

PULSATILLA, U. S.—Pulsatilla.—The herb of *Anemone Pulsatilla* and *Anemone pratensis*, Linné, collected soon after flowering. Should be carefully preserved, and not be kept longer than one year; contains an acrid, odorous, resinous substance, coloring matter, gum, etc. The acrid principle may be converted into *anemonin*, $C_{15}H_{12}O_6$, which, through the action of alkalies, becomes anemonic acid.

APOCYNUM, U. S.—Apocynum. (*Canadian Hemp.*)—The root of *Apocynum cannabinum* contains resin, *apocynin*, *apocynein*, bitter extractive, tannin, etc.

Official Preparation.—Extractum Apocyni Fluidum.

ASCLEPIAS, U. S.—Asclepias. (*Pleurisy Root.*)—The root of *Asclepias tuberosa* contains resins, volatile principle, tannin, mucilage, etc.

Official Preparation.—Extractum Asclepiadis Fluidum.

LACTUCARIUM, U. S.—Lactucarium.—The concrete milk-juice of *Lactuca virosa* contains a bitter resinous principle, *lactucin*, $C_{11}H_{12}O_3.H_2O$, *lactucic acid* (bitter and crystalline), *lactucopicrin* (bitter and amorphous), *lactucerin* in large quantity, nearly 60 per cent. (this principle is inert and crystallizable), caoutchouc, resin, asparagin, volatile oil, mucilage, etc.

Official Preparations.—Tinctura Lactucarii, Syrupus Lactucarii.

RESINS, OLEORESINS, GUM-RESINS, AND BALSAMS.

What are Resins? Natural or induced, solid or semi-solid exudations from plants, characterized by being insoluble in water, mostly soluble in alcohol, uncrystallizable, and softening and melting at a moderate heat.

What are they chemically? Mixed products. Some of them are acids, and combine with alkalies, forming soaps, as in the case of common resin. They are commonly the oxidized terpenes of plants.

Describe them. When pure, they are usually transparent, hard, and brittle; when they contain water, are opaque and no longer hard, and brittle.

Into what three Classes are they usually Divided? Natural Oleoresins (oil and resin), generally obtained by incising the trunks of trees which contain them; ex., turpentine. Gum resins; natural mixtures of gum and resin—usually exudations from plants; ex., myrrh. Balsams, resinous substances which contain benzoic, cinnamic, or analogous acids; ex., balsam of tolu.

TEREBINTHINA, U. S.—Turpentine.—A concrete oleoresin obtained from *Pinus palustris* and from other species of *Pinus;* contains abietic anhydride, which may be converted into abietic acid, $C_{44}H_{64}O_5$, a bitter principle, and 25 per cent. of volatile oil.

OLEUM TEREBINTHINÆ, U. S.—Oil of Turpentine volatile oil distilled from turpentine; has the composition $C_{10}H_{16}$, a *the type of the terpenes.*

Official Preparation.—Linimentum Terebinthinæ.

OLEUM TEREBINTHINÆ RECTIFICATUM, U. S.—Rectified Oil of Turpentine.—A thin, colorless liquid, having the general properties mentioned under Oil of Turpentine. Made by distilling Oil of Turpentine with Lime Water.

TEREBENUM, U. S.—Terebene, $C_{10}H_{16}$; 135.7.—A liquid consisting chiefly of Pinene, and containing not more than very small portions of Terpinene and Dipentene. A colorless, or slightly yellowish, thin liquid, having a rather agreeable, thyme-like odor, and an aromatic, somewhat terebinthinate taste; sp. gr. about 0.862 at 15° C. (59° F.). Only slightly soluble in water, but soluble in an equal volume of alcohol, glacial acetic acid, or carbon disulphide.

TERPINI HYDRAS, U. S.—Terpin Hydrate, $C_{10}H_{18}(OH)_2 + H_2O$; 189.58.—The hydrate of the diatomic alcohol terpin. Colorless, lustrous, rhombic prisms, nearly odorless, and having a slightly aromatic and somewhat bitter taste. Permanent in the air. Soluble at 15° C. (59° F.) in about 50 parts of water, and in 10 parts of alcohol, in 32 parts of boiling water, and in 2 parts of boiling alcohol; also soluble in about 100 parts of ether, 200 parts of chloroform, or 1 part of boiling glacial acetic acid. Made by acting on a mixture of oil of turpentine with nitric acid.

RESINA, U. S.—Resin. (*Colophony.*)—The residue left after distilling off the volatile oil from turpentine consists of abietic anhydride, which passes into abietic acid when treated with diluted alcohol. It is a transparent, amber-colored substance, hard, brittle, with a glossy and shallow conchoidal fracture, and having a faintly terebinthinate odor and taste; sp. gr. 1.070 to 1.080.

Official Preparations.—Ceratum Resinæ, Emplastrum Resinæ.

TEREBINTHINA CANADENSIS, U. S.—Canada Turpentine. (*Balsam of Fir.*)—A liquid oleoresin obtained from *Abies balsamea*. It contains resin, associated with a terpene, $C_{10}H_{16}$, and a small quantity of a bitter principle. It is a yellowish or faintly greenish, transparent, viscid liquid; of an agreeable, terebinthinate odor, and a bitterish, slightly acrid taste.

MASTICHE, U. S.—Mastic.—A concrete, resinous exudation from *Pistacia Lentiscus*, containing a resin (mastichic acid, $C_{20}H_{32}O_2$), which is soluble in strong alcohol; also masticin, a resinous principle, which is insoluble in alcohol; a small quantity of volatile oil is likewise present.

PIX BURGUNDICA, U. S.—Burgundy Pitch.—The prepared, resinous exudation of *Abies excelsa* contains resin, a small quantity of a terpene $C_{10}H_{16}$, and water.

Official Preparations.—Emplastrum Picis Burgundicæ, Emplastrum Picis cum Cantharide.

AMMONIACUM, U. S.—Ammoniac.—A gum resin obtained from *Dorema Ammoniacum* contains about 25 per cent. of gum, 70 per cent. of resin. and about 3 per cent. of volatile oil. The resin is remarkable for

potassa.

moniaci, Emplastrum Ammoniaci

m-resin obtained from the

root of *Ferula fœtida.* It contains a sulphurated volatile oil (ferulyl sulphide), about 20 per cent. of gum, and 70 per cent. of resin.

Official Preparations.—Emulsum Asafœtidæ, Tinctura Asafœtidæ, Pilulæ Asafœtidæ.

ELASTICA, U. S.—India-Rubber. (*Caoutchouc.*)—The prepared milk-juice of various species of *Hevea*, known in commerce as Para Rubber.

MYRRHA, U. S.—Myrrh.—A gum resin obtained from *Commiphora Myrrha;* contains 3 per cent. of an oxygenated volatile oil, a bitter principle, and about 30 per cent. of gum and 60 per cent. of resin.

Official Preparation.—Tinctura Myrrha.

GUAIACI LIGNUM, U. S.—Guaiacum Wood.—The heart-wood of *Guaiacum officinale* and of *Guaiacum sanctum* owes its virtues to resin, which is present, usually, to the amount of 25 per cent.

GUAIACI RESINA, U. S.—Guaiac.—The resin of the wood of *Guaiacum officinale* consists of *guaiacic acid* ($C_{12}H_{16}O_6$), *guaiaconic acid* ($C_{19}H_{20}O_5$), *guaiaretic acid* ($C_{20}H_{26}O_4$), beta resin, gum, etc.

Official Preparations.—Tinctura Guaiaci, Tinctura Guaiaci Ammoniata.

BALSAMUM TOLUTANUM, U. S.—Balsam of Tolu.—A balsam obtained from *Toluifera Balsamum* contains *cinnamic* and *benzoic acids*, resins, a volatile oil called *benzyl benzoate*, $C_7H_5(C_7H_7)O_2$, *benzyl cinnamate*, a terpene $C_{10}H_{16}$, termed *tolene*, and other unimportant constituents.

Official Preparations.—Tinctura Tolutana, Syrupus Tolutanus.

BALSAMUM PERUVIANUM, U. S.—Balsam of Peru.—The balsam obtained from *Toluifera Pereiræ* contains *cinnamic* and *benzoic acids*, *benzyl cinnamate*, $C_9H_7(C_7H_7)O_2$, resin, *benzyl-benzoate*, stilbene, etc.

Description.—A liquid having a syrupy consistency free from stringiness or stickiness, of a brownish-black color in bulk, reddish-brown and transparent in thin layers; somewhat smoky, but agreeable and vanilla-like odor; bitter taste, leaving a persistent after taste; acid reaction.

BENZOINUM, U. S.—Benzoin.—The balsamic resin obtained from *Styrax Benzoin*, contains benzoic acid, cinnamic acid ($C_9H_8O_2$), a fragrant, volatile oil, and resins; in some varieties vanillin is found.

Official Preparations.—Adeps Benzoinatus, Tinctura Benzoini, Tinctura Benzoini Composita.

STYRAX, U. S.—Storax.—The balsam prepared from the inner bark of *Liquidambar orientalis* contains cinnamic acid, benzoic acid, *styracin*, $C_9H_7(C_9H_9)O_2$, *storesin*, $C_{36}H_{58}O_3$, *ethyl cinnamate*, $C_9H_7(C_2H_5)O_2$, *phenyl propyl cinnamate*, $C_9H_7(C_9H_{17})O_2$, *styrol*, C_8H_8, a fragrant hydrocarbon, and a resinous substance not yet investigated.

ACIDUM BENZOICUM, U. S.—Benzoic Acid. $HC_7H_5O_2$; 121.71.—White, or yellowish-white, lustrous scales, or friable needles, permanent in the air; slight aromatic odor of benzoin; a warm acid taste; acid reaction. It is found natural in benzoin, balsam of tolu, etc., but is usually made artificially—

1. From the urine of cattle, by treating it with lime, evaporating, decomposing the lime hippurate with HCl, purifying the hippuric acid with animal charcoal, and treating with HCl, when benzoic acid and glycocine are produced :—

$$\underset{\text{Hippuric Acid.}}{C_9H_9NO_3} + \underset{\text{Water.}}{H_2O} = \underset{\text{Benzoic Acid.}}{C_7H_6O_2} + \underset{\text{Glycocine.}}{C_2H_5NO_2}.$$

2. From *naphtalin*, $C_{10}H_8$, by treating it with HNO_3; *phthalic* acid is produced, which, when heated with excess of $Ca(HO)_2$, yields calcium benzoate and carbonate :—

$$\underset{\text{Phthalic Acid.}}{C_8H_6O_4} = \underset{\text{Benzoic Acid.}}{C_7H_6O_2} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

3. From trichlormethyl-benzol, a coal-tar hydrocarbon from toluol, C_7H_8, by heating with zinc chloride and acetic acid, by which benzoic acid is formed and HCl liberated.

FIXED OILS, FATS, AND SOAPS.

What is the Source of Fixed Oils and Fats, and how are they Distinguished? They are obtained from both the vegetable and animal kingdoms. *Characteristics.*—Greasy to the touch, leave a permanent oily stain on paper; insoluble in water, but soluble in ether, chloroform, carbon disulphide, benzol, benzin, turpentine, and volatile oils, usually mixing with one another without separating; when pure, generally colorless or of a pale yellow color, with distinctive odor and taste, often caused by impurities, as they are rendered odorless and tasteless by refining them. When heated moderately, if solid, they melt; if liquid, they become thinner; decomposed by heating strongly in the air, with evolution of offensive vapors, they burn with a sooty flame and much heat. Sp. gr. 0.870 to 0.985. On exposure to air, they acquire an acrid, disagreeable taste and acid reaction, owing to a change that occurs, termed rancidity, believed to be due to impurities, like albuminous substances, which act as ferments, induce decomposition, liberate the fatty acids, and produce volatile, odorous acids, like caproic, caprylic, butyric, and valerianic acids. Rancid oils may often be purified by shaking thoroughly with hot water, then with a cold solution of CO_2, and washing with cold water.

What are Fixed Oils chemically? They are ethers of the higher members of the fatty acids, the alcohol being glycerin and the radical glyceryl. As they consist, in most cases, of two or three proximate principles, called olein, palmitin or stearin in combination with glyceryl, they are sometimes called glycerides of oleic, palmitic, and stearic acids. The consistency of fixed oils and fat vary, on account of these proximate principles, which occur in various proportions. Olein is liquid, the other two solid. Almond oil being principally composed of olein, is, at ordinary temperatures, liquid; tallow being largely stearin, is solid at the same temperatures.

What is Olein? The oleate of the triad radical glyceryl, having the chemical composition $C_3H_5(C_{18}H_{33}O_2)_3$, obtained by treating oils or fats with boiling alcohol, cooling, to deposit the concrete principles, the olein remaining in solution, which is obtained by evaporating off the alcohol, or by compressing one of the solid fats, or a liquid fat concreted by cold, between folds of bibulous paper, which absorb the olein and give it up afterward by compressing under water.

Describe Olein. It is a liquid of oily consistence, congealing at —6° C. (21.2° F.); colorless, when pure; with little odor and a sweetish taste; insoluble in water, soluble in boiling alcohol and ether.

What is Palmitin? The glyceride of palmitic acid, or tripalmitate of glyceryl.

What is Stearin? A glyceride of stearic acid, $C_3H_5(C_{18}H_{35}O_2)_3$, and has been formed synthetically by heating a mixture of these two materials to 280°–300° C.

Describe it and its Method of Preparation. A white, opaque mass, of a pearly appearance as crystallized from ether, pulverizable, fusible at 66.5° C. (152° F.), soluble in boiling alcohol and ether, nearly insoluble in those liquids cold, insoluble in water. Prepared by dissolving suet in hot oil of turpentine, cooling, expressing with unsized paper, dissolving in hot ether, which deposits the stearin on cooling.

What is Margarin? A compound of stearin and palmitin—once regarded as a principle.

What is Stearic Acid? A firm, white solid, like wax, with chemical composition $C_{18}H_{36}O_2$, fusible at 69.2° C. (157° F.), greasy to the touch, pulverizable, soluble in alcohol, very soluble in ether, insoluble in water.

Describe Palmitic Acid. Palmitic acid, $C_{16}H_{32}O_2$, forms a white, scaly mass, melting at 62° C. (143.6° F.).

Describe Oleic Acid. An oily liquid, soluble in alcohol and ether, lighter than water, in which it is insoluble; crystallizable in needles at a temperature a little below zero C. (32° F.); having a slight smell and pungent taste; chemical composition, $C_{18}H_{34}O_2$.

AMYGDALA DULCIS, U. S.—Sweet Almond.—The seed of *Prunus amygdalus*, var. *dulcis*, contains about 40 per cent. of fixed oils, protein compounds (*conglutin* and *amandin*), sugar, mucilage, etc.

Official Preparations.—Emulsum Amygdalæ, Syrupus Amygdalæ.

OLEUM AMYGDALÆ EXPRESSUM, U. S.—Expressed Oil of Almond.—A fixed oil expressed from bitter or sweet almond. A clear, pale straw-colored, or colorless, oily liquid; almost inodorous; mild, nutty taste; its sp. gr. is from 0.915 to 0.920. It consists principally of olein 70 per cent.

OLEUM OLIVÆ, U. S.—Olive Oil.—A fixed oil, expressed from the ripe fruit of *Olea europæa*. It is a pale yellow or light greenish-yellow, oily liquid; slight, peculiar odor; nutty, oleaginous taste, with a faintly acrid after-taste; neutral reaction.

OLEUM GOSSYPII SEMINIS, U. S.—Cotton Seed Oil.

OLEUM SESAMI, U. S.—Oil of Sesamum. (*Benné Oil.*)

OLEUM LINI, U. S.—Linseed Oil.

PEPO, U. S.—Pumpkin Seed.—The seed of *Cucurbita pepo* contains about 40 per cent. of fixed oil, starch, protein compounds, a little acrid resin, sugar, etc.

OLEUM RICINI, U. S.—Castor Oil.—A fixed oil expressed from the seed of *Ricinus communis.*

Preparation.—Castor oil has been obtained from the seed in four ways: 1. By cold expression; 2. By expression with heat; 3. By percolation with alcohol; 4. By decoction. The first method produces the best oil. It is an almost colorless, transparent, viscid liquid, of a faint, mild odor; a bland, afterward slightly acrid, and generally offensive taste, and a neutral reaction; sp. gr. 0.950 to 0.970. It contains *ricinolein* and palmitin.

OLEUM TIGLII, U. S.—Croton Oil.

OLEUM THEOBROMATIS, U. S.—Oil of Theobroma. (*Oil of Theobromæ, Pharm.* 1880. *Butter of Cacao.*)—A fixed oil expressed from the seed of *Theobroma cacao* by expressing the kernels of the "chocolate nut" between hot iron plates, and running the product into moulds. The yield is about 40 per cent. It is a yellowish-white solid, having a faint, agreeable odor; a bland, chocolate-like taste, and a neutral reaction. It melts between 30° and 35° C. (86° to 95° F.).

Chemically, it is a mixture of stearin, palmitin, olein, arachin, and laurin, and, owing to its low fusing point and its property of becoming solid at a temperature just above the fusing point, it is valuable in pharmacy in making suppositories.

LYCOPODIUM, U. S.—Lycopodium.—The sporules of *Lycopodium clavatum* and of other species of *Lycopodium* contain 47 per cent. of fixed oil, with minute quantities of volatile bases.

ACIDUM OLEICUM, U. S.—Oleic Acid. $HC_{18}H_{33}O_2$; 281.38.—An organic acid, prepared in a sufficiently pure condition by cooling commercial oleic acid to about 5° C. (41° F.), then separating and preserving the liquid portion. A yellowish, oily liquid, gradually becoming brown, rancid, and acid when exposed to air; lard-like odor and taste; when pure, of a neutral reaction; feebly acid reaction in alcoholic solution; sp. gr. 0.900. Obtained as a by-product in the manufacture of candles from fats.

Red oil is crude oleic acid.

ACIDUM STEARICUM, U. S.—Stearic Acid. $HC_{18}H_{35}O_2$; 283.38.—An organic acid, in its commercial, more or less impure, form, usually obtained from the more solid fats, chiefly tallow. A hard, white, somewhat glossy solid, odorless and tasteless, and permanent in the air. Insoluble in water; soluble in about 45 parts of alcohol at 15° C. (59° F.); readily soluble in boiling alcohol and ether. Used for making Suppositoria Glycerini.

GLYCERINUM, U. S.—Glycerin.—A clear, colorless liquid, of syrupy consistence, oily to the touch, hygroscopic; odorless; very sweet and slightly warm to the taste; neutral reaction. Obtained by the decomposition of fats or fixed oils, and containing not less than 95 per cent. of absolute glycerin ($C_3H_5(HO)_3$; 92).

Preparation.—Glycerin is made in several ways:—

1. Through the saponification of fats and oils, in making soap or lead plaster:—

$$\underset{\substack{\text{Glyceryl Oleate}\\ \text{(Olive Oil)}}}{2(C_3H_53C_{18}H_{33}O_2)} + \underset{\substack{\text{Lead Oxide}\\ \text{(Lith}}}{3PbO} + 3H_2O =$$

$$\underset{\substack{\text{Lead Oleate}\\ \text{(Lead Plaster).}}}{3(Pb2C_{18}H_{33}O_2)} +$$

2. By the decomposition of fats and oils through pressure and superheated steam, whereby the fats, which are *glycerides*, or ethers of the fatty acids, are broken up into glycerin and fatty acids, the water supplying the elements of hydrogen and oxygen necessary for that change. The decomposition of *stearin* in this way will illustrate:—

$$\underset{\text{Stearin.}}{C_3H_53C_{18}H_{35}O_2} + \underset{\text{Water.}}{3H_2O} = \underset{\text{Glycerin.}}{C_3H_53HO} + \underset{\text{Stearic Acid.}}{3HC_{18}H_{35}O_2}.$$

In this, its present form, it is known as *distilled glycerin*.

Glycerin is the hydrate of the radical *glyceryl*, therefore an alcohol, and is sometimes called *glycerol* or *glyceric alcohol*. It is triatomic, and one, two, or three of the hydrogen atoms may be replaced by monad radicals.

SAPO, U. S.—Soap. (*White Castile Soap.*)—Soap prepared from soda and olive oil. It is a white or whitish solid, hard, yet easily cut when fresh; with a slight, peculiar odor; free from rancidity; disagreeable, alkaline taste; alkaline reaction.

Official Preparations.—Emplastrum Saponis, Linimentum Saponis.

SAPO MOLLIS, U. S.—Soft Soap. (*Sapo Viridis, Pharm. 1880. Green Soap.*)—A soft soap, generally imported from Germany; prepared from potassa and various fixed oils, containing but little stearin. It is a soft, greenish-yellow, unctuous jelly, having a peculiar odor, which should be free from rancidity, and an alkaline reaction.

Official Preparation.—Linimentum Saponis Mollis.

Unsaponifiable Fats and Petroleum Products.

PETROLATUM LIQUIDUM, U. S.—Liquid Petrolatum.—A mixture of hydrocarbons, chiefly of the marsh-gas series, obtained by distilling off the lighter and more volatile portions from petroleum, and purifying the residue when it has the desired consistence. A colorless, or more or less yellowish, oily, transparent liquid, without odor or taste, or giving off, when heated, a faint odor of petroleum. Sp. gr. about 0.875 to 0.945 at 15° C. (57° F.). Insoluble in water; scarcely soluble in cold or hot alcohol, but soluble in boiling absolute alcohol, and readily soluble in ether, chloroform, carbon disulphid, oil of turpentine, benzin, benzol, and fixed or volatile oils.

PETROLATUM MOLLE.—Soft Petrolatum. (*Petrolatum, Pharm. 1880. Soft Petroleum Ointment.*)—A fat-like mass, of about the consistency of an ointment, varying from white to yellowish or yellow, more or less fluorescent when yellow, especially after being melted; transparent in thin layers, completely amorphous, and without odor or taste, or giving off when heated a faint odor of petroleum. Consisting of hydrocarbons, chiefly of the marsh-gas series ($C_{16}H_{34}$; etc.). Obtained by distilling off the lighter and more volatile portions from American petroleum, and purifying the residue. Melting point about 40° C. to 45° C. (104° F. to 113° F.).

If a portion be liquefied, and brought to a temperature of 60° C. (140° F.), it will have a sp. gr. of about 0.820 to 0.840.

When petrolatum is prescribed or ordered without further specification, soft petrolatum is to be dispensed.

Petrolatum is known commercially as *cosmoline*, *vaseline*, *petrolina*, *deodorolina*, etc.

PARAFFIN.—The degree of hardness of petrolatum is due to the greater or less proportion of paraffin present. This substance may be obtained in a pure form by distilling the residuum obtained from the refiners of petroleum, and collecting and purifying the distillate. In its pure state it is a white, waxy, inodorous, tasteless substance, harder than tallow, softer than wax. Sp. gr. 0.877; melting point ranges between 43° C. and 65° C. (109° F. and 151° F.).

If a portion be liquefied and brought to a temperature of 60° C. (140° F.), it will have a sp. gr. of about 0.820 to 0.850. Range of melting point about 45° and 51° C. (113° and 125° F.).

PETROLATUM SPISSUM, U. S.—Hard Petrolatum. (*Petrolatum, Pharm. 1880. Hard Petroleum Ointment.*)—A mixture of hydrocarbons, chiefly of the marsh gas series, obtained by distilling off the lighter and more volatile portions from petroleum, and purifying the residue when it has the desired melting point. A fat-like mass, of about the consistence of cerate, varying from white to yellowish or yellow, more or less fluorescent when yellow, especially after being melted; transparent in thin layers, completely amorphous, and without odor or taste, or giving off, when heated, a faint odor of petroleum.

BENZINUM, U. S.—Benzin. (*Petroleum Benzin. Petroleum Ether.*)—A transparent, colorless, diffusive liquid, with a strong, characteristic odor, slightly resembling that of petroleum, but much less disagreeable, neutral reaction. It is a purified distillate from American petroleum, consisting of hydrocarbons, chiefly of the marsh-gas series (C_5H_{12}, C_6H_{14}, and homologous compounds), having a sp. gr. from 0.670 to 0.675, and boiling at 50° to 60° C. (122° to 140° F.).

Benzin should be carefully kept in well-stoppered bottles or cans, in a cool place, remote from lights or fire; for it is highly inflammable, and its vapor, when mixed with air and ignited, explodes violently.

OFFICIAL VOLATILE OILS.

Natural Order. Official and English Names	Source. Other Important Constituents besides Volatile Oil.	Part from which Oil is Derived. Per Cent. of Yield.	Chemical Composition of Oil.
Rutaceæ.			
OLEUM, ...	Citrus aurantii (sweet orange).	Cortex (rind).	Composition of the terpenes, $C_{10}H_{16}$.
Aurantii Corticis (Orange Peel), ...	Citrus vulgaris (bitter orange) *hesperidin.*		
Aurantii Florum (Orange Flower) (Oil of Neroli), . .	Citrus vulgaris.	Flowers.	Very fragrant terpene, $C_{10}H_{16}$.
Limonis (Lemon), ...	Citrus limonum, *hesperidin.*	Cortex (fresh lemon peel).	Terpene, $C_{10}H_{16}$.
Bergamottæ (Bergamot), . .	Citrus bergamia, var. vulgaris.	Cortex (rind of fresh fruit).	Terpene, $C_{10}H_{16}$.
Labiateæ.			
Menthæ Piperitæ (Peppermint), ...	Mentha piperita.	Leaves and tops 2 %.	Menthol, a stearopten, $C_{10}H_{20}O$.
Menthæ Viridis (Spearmint),	Mentha viridis.	Leaves and tops ½ to 1 %.	Oxygenated oil, $C_{10}H_{14}O$, and a terpene, $C_{10}H_{18}O$.
Lavandulæ Florum (Lavender Flowers), ...	Lavandula officinalis.	Fresh flowers.	$C_{10}H_{16}$, and compound ethers, $C_{10}H_{16}O$, $C_{10}H_{18}O$.
Rosmarini, ...	Rosmarinus officinalis.	Leaves.	$C_{10}H_{16}$, and compound ethers, $C_{10}H_{16}O$, $C_{10}H_{18}O$.
Hedeomæ (Pennyroyal), . .	Hedeoma pulegioides.	Leaves and tops.	Oxygenated oil.
Thymi (Thyme) (Oil of Origanum), ...	Thymus vulgaris.	Leaves and flowering tops.	Mixture of cymene, $C_{10}H_{14}$, thymene, $C_{10}H_{16}$; the latter is chiefly thymol, $C_{10}H_{14}O$.
Umbelliferæ.			
Cari (Caraway), ...	Carum carvi.	Fruit, 5 %.	A carvene, terpene, $C_{10}H_{16}$, and carvol, $C_{10}H_{14}$.
Fœniculi (Fennel), ...	Fœniculum capillaceum.	Fruit, 5 %.	Terpene, $C_{10}H_{16}$, and anethol, $C_{10}H_{12}O$.
Coriandri (Coriander), . . .	Coriandrum sativum.	Fruit, 1 %.	$C_{10}H_{18}O$.
Anisi (Anise), ...	Pimpinella anisum.	Fruit, 2 %.	$C_{10}H_{16}$, and anethol (mainly), $C_{10}H_{12}O$.
Laurineæ.			
Cinnamomi (Cassia), ...	Undetermined species of cinnamomum.		Cinnamic aldehyde, C_9H_8O, oxydizing, first into cinnamic acid, $C_9H_8O_2$, then into benzoic acid, $C_7H_6O_2$.
Sassafras (Sassafras), ...	Sassafras variifolium.	Bark of root.	Terpene, *safran*, $C_{10}H_{16}$, oxygenated portion, *safrol*, $C_{10}H_{10}O_2$.

Myrtaceæ.			
OLEUM Caryophylli (Cloves), ...	Eugenia aromatica, *caryophyllin*, $C_{10}H_{16}O$, *eugenin*, $C_{10}H_{12}O_2$.	Unexpanded flowers, 16 %.	Mixture of two oils. Light oil is $C_{10}H_{16}$. Heavy oil consists of eugenol (eugenic acid), $C_{10}H_{12}O_2$, which can be converted into vanillin.
Pimentæ (Pimenta, Allspice),	Pimenta officinalis.	Nearly ripe fruit.	Terpene, $C_{10}H_{18}$, and eugenol, $C_{10}H_{12}O_2$.
Myrciæ (Myrcia, Oil of Bay),	Myrcia acris.	Leaves.	Terpene, $C_{10}H_{16}$, and eugenol, $C_{10}H_{12}O_2$.
Cajuputi (Cajuput), ...	Melaleuca leucodendron.	Leaves.	$C_{10}H_{16}H_2O$ = cajuputene hydrate, or cajuputol.
Eucalypti, ...	Eucalyptus globulus.	Fresh leaves.	Eucalyptol, $C_{10}H_{16}O$, two terpenes, $C_{10}H_{14}$, $C_{10}H_{16}$.
Myristicaceæ.			
Myristicæ (Nutmeg), ...	Myristica fragrans.	Seed, deprived of its testa.	Terpene, $C_{10}H_{16}$, and an oxygenated portion, myristicol, $C_{10}H_{14}O$.
Ericaceæ.			
Gaultheriæ (Gaultheria, Wintergreen), ...	Gaultheria procumbens.	Leaves.	Principally methyl salicylate, $CH_3C_7H_5O_3$, and nearly identical with oil of Betula, also a terpene, *gaultheriline*, $C_{10}H_{16}$.
Betulaceæ.			
Betulæ Volatile (Volatile Oil of Betula, Oil of Sweet Birch), ...	Betula lenta.	Bark.	Identical with methyl salicylate, $CH_3C_7H_5O_3$; nearly identical with oil of Gaultheria.
Methyl Salicylas, Methyl Salicylate, Artificial (or Syntic) Oil of Wintergreen.	A colorless, or slightly yellowish liquid; strongly aromatic odor and sweetish, warm and aromatic taste of Oil of Gaultheria; neutral or chiefly acid reaction. Wholly identical with the volatile oil of betula.		
osaceæ.			
Amaræ (Oil of nd), ...	Prunus amygdalus, var. amara.	Seed.	Benzyl-aldehyd, C_7H_6O.
feræ.			
(Volatile Oil	Brassica nigra.	Seed.	Allyl-iso-thiocyanate, also called allyl-sulpho-cyanide.
ceæ.			
Cubeb), . . .	Piper cubeba.	Unripe fruit, 10 %.	Contains a hydrocarbon, terpene, $C_{10}H_{16}$, and two oils of the formula, $C_{15}H_{24}$.

OFFICIAL VOLATILE OILS.—*Continued.*

NATURAL ORDER. OFFICIAL AND ENGLISH NAMES	SOURCE. OTHER IMPORTANT CONSTITUENTS BESIDES VOLATILE OIL.	PART FROM WHICH OIL IS DERIVED. PER CENT. OF YIELD.	CHEMICAL COMPOSITION OF OIL.
Leguminosæ.			
OLEUM Copaibæ (Oil of Copaiba), . .	Copaiba langsdorffi and other species.	Oleoresin.	Is a hydrocarbon, consisting of $C_{10}H_{16}$, terpene, and $C_{15}H_{24}$.
Santalaceæ.			
Santali (Oil of Santal, Oil of Sandalwood), ...	Santalum album.	Wood.	Oxygenated oil, consisting of $C_{15}H_{24}O$ and $C_{15}H_{26}O$.
Chenopodiaceæ.			
Chenopodii (Oil of Chenopodium; Oil of American Wormseed), ...	Chenopodium ambrosioides (var. anthelminticum).	Fruit.	Consists of a terpene, $C_{10}H_{16}$, and an oxygenated portion, $C_{10}H_{16}O$.
Coniferæ.			
Juniperi (Oil of Juniper), . .	Juniperis communis.	Fruit.	A terpene, $C_{10}H_{16}$.
Sabinæ (Oil of Savine), . . .	Juniperus sabina.	Tops.	A terpene, $C_{10}H_{16}$.
Terebinthinæ (Oil of Turpentine), ...	Pinus palustris and other species.	Oleoresin, 25 %.	A terpene, $C_{10}H_{16}$.
Terebinthinæ Rectificatum (Rectified Oil of Turpentine).			
Compositæ.			
rigerontis (Oil of Erigeron; il of Fleabane), ...	Erigeron canadense.		A terpene, $C_{10}H_{16}$, and an oxygenated portion.

FIXED OILS.

osaceæ.			
Expressum (Ex- Oil of Almond; weet Almond), . .	Prunus amygdalus, var. dulcis.	Seed, 35 %–40 %.	Olein, 70 %.
leaceæ.			
ive Oil), ...	Olea europœa.	Ripe Fruit.	
alvaceæ			
Seminis (Cotton l), ...	Gossypium herbaceum and other species.	Seed, 15 %.	
daliaceæ.			
l of Sesamum: Se- ; Teel Oil; Benné	Sesamum indicum.	Seed.	Olein, 70 %; palmitin, stearin and myristicin.
Lineæ.			
inseed Oil; Oil of eed), ...	Linum usitatissimum.	Seed, 20 %–35 %.	Consists mainly of linolein, which by exposure becomes linoxyn, $C_{32}H_{34}O_{11}$; myristin and palmitin are also present.
Euphorbiaceæ.			
cini (Castor Oil), ...	Ricinus communis.	Seed.	Contains ricinolein and palmitin.
iglii (Croton Oil), ...	Croton tiglium.	Seed.	Crotonol, $C_{18}H_{28}O_4$, is said to be present.
Sterculiaceæ.			
Theobromatis (Oil of Theobroma; Butter of Cacao), .	Theobroma cacao.	Seed, 40 %.	A mixture of stearin, palmitin, olein, arachin and laurin.

DRUGS CONTAINING GLUCOSIDES OR NEUTRAL PRINCIPLES, WITH THEIR PREPARATIONS.

Glucosides are bodies mostly found in plants yielding glucose, $C_6H_{12}O_6$, as one of their products of decomposition when heated in contact with a diluted mineral acid and water. The other product which is formed at the same time differs in character from the original glucoside. Thus, *Salicin*, if boiled with diluted sulphuric acid, yields dextro-glucose and *saligenin*, or *saligenol.*

$$\underset{\text{Salicin.}}{C_{13}H_{18}O_7} + \underset{\text{Water.}}{H_2O} = \underset{\text{Saligenin.}}{C_7H_8O_2} + \underset{\text{Glucose.}}{C_6H_{12}O_6}.$$

Glucosides may sometimes be split into glucose and the derived product by heating them with baryta water or alkaline solutions, by nitrogenous principles, which act as ferments, like *emulsin* or *synaptase*, or by treatment with yeast ferment or *ptyalin* found in saliva.

Glucosides are sometimes the active principles of the plants in which they are found, but they are more frequently associated with resins, oils, alkaloids, and bitter principles.—Remington.

GENTIANA, U. S.—Gentian.—The root of *Gentiana lutea* contains the glucoside *gentiopicrin* (which splits, when heated with dilute acids, into gentiogenin and grape sugar), *gentisic* acid, $C_{14}H_{10}O_5$, pectin, sugar (gentianose), and a little fixed oil.

Official Preparations.—Extractum Gentianæ Fluidum, Extractum Gentianæ, Tinctura Gentianæ Composita.

CALUMBA, U. S.—Calumba. (*Columbo.*)—The root of *Jateorrhiza palmata* owes its virtues to *colombin*, $C_{21}H_{22}O_7$, and *berberine*, both of which are very bitter; starch and colombic acid are present, with a mucilage which is often troublesome by interfering with percolating operations.

Official Preparations.—Extractum Calumbæ Fluidum, Tinctura Calumbæ.

QUASSIA, U. S.—Quassia.—The wood of *Picræna excelsa* contains *quassin*, $C_{10}H_{12}O_3$, which is intensely bitter and soluble in both alcohol and water; there are also present resin, mucilage, etc.

Official Preparations.—Extractum Quassiæ Fluidum, Extractum Quassiæ, Tinctura Quassiæ.

CHIRATA, U. S.—Chirata.—*Swertia Chirata* contains a bitter glucoside, *chiratin*, $C_{26}H_{48}O_{15}$, and a very bitter principle, ophelic acid, $C_{13}H_{20}O_{10}$.

Official Preparations.—Extractum Chiratæ Fluidum, Tinctura Chiratæ.

SALICINUM, U. S.—Salicin. $C_{13}H_{18}O_7$; 285.33—Colorless, or white, silky, shining, crystalline needles, permanent in the air; odorless; very bitter taste; neutral reaction. Prepared by removing gum, tannin, and extractive matter from a boiling concentrated decoction of the bark by treating it with lead oxide, separating the portion of lead oxide solved in combination, probably with the salicin, with H_2SO_4 and filtering, evaporating, and purifying the deposited salicin by repeated tion and crystallization. Salicin is a glucoside, splitting into saligenin and sugar under the influence of dilute acids and heat.

TARAXACUM, U. S.—Taraxacum. (*Dandelion.*)—The root of *Taraxacum officinalis*, gathered in autumn, owes its bitterness to *taraxacin*, $C_8H_{16}O$, an acrid crystalline principle, soluble in alcohol and water; it also contains pectin, sugar, resin, gum, etc.

Official Preparations.—Extractum Taraxaci Fluidum, Extractum Taraxaci.

LAPPA, U. S.—Lappa. (*Burdock.*)—The root of *Arctium Lappa* and other species of Lappa contains a bitter substance, inulin, sugar, mucilage, etc.

Official Preparation.—Extractum Lappæ Fluidum.

SCILLA, U. S.—Squill.—The sliced bulb of *Urginea maritima* contains the bitter principle *scillipicrin*, *scillitoxin*, *scillin*, and *scillain*, a poisonous glucoside. There are also present a large quantity of mucilage, calcium oxalate, sinistrin, etc.

Official Preparations.—Acetum Scillæ, Extractum Scillæ Fluidum, Syrupus Scillæ, Syrupus Scillæ Compositus, Tinctura Scillæ.

DIGITALIS, U. S.—Digitalis. (*Foxglove.*)—The leaves of *Digitalis purpurea*, collected from plants of the second year's growth.

Digitalis has been the subject of exhaustive investigation. The principle digitalin was at one time considered to be an alkaloid. It is, as usually seen, a mixture of digitoxin and other neutral principles. Digitoxin is converted into *toxiresin* by the action of diluted acids and heat.

Official Preparations.—Infusum Digitalis, Extractum Digitalis Fluidum, Extractum Digitalis, Tinctura Digitalis.

STROPHANTHUS, U. S.—Strophanthus.—The seed of *Strophanthus hispidus*, deprived of its long awn, contains a glucoside, strophanthin, which yields, on decomposition, glucose and *strophanthidin*.

Official Preparation.—Tinctura Strophanthi.

SPIGELIA, U. S.—Spigelia. (*Pinkroot.*)—The rhizome and rootlets of *Spigelia marilandica* contain a bitter principle, resin, and a trace of volatile oil, with tannin and wax.

Official Preparation.—Extractum Spigeliæ Fluidum.

CUSSO, U. S.—Kousso. (*Brayera, Pharm. 1880.*)—The female inflorescence of *Hagenia abyssinica* contains a bitter resinous principle, kosin, $C_{31}H_{38}O_{10}$, about 24 per cent. of tannin, gum, sugar, etc.

Official Preparation.—Extractum Cusso Fluidum.

SANTONICA, U. S.—Santonica. (*Levant Wormseed.*)—The unexpanded flower-heads of *Artemisia pauciflora*, contain about 2 per cent. of *santonin*, resin, volatile oil, gum, etc.

SANTONINUM, U. S.—Santonin. $C_{15}H_{18}O_3$; 245.43.—A neutral principle prepared from santonica.

It should be kept in dark, amber-colored vials, and should not be exposed to light.

Description.—Santonin occurs in colorless, shining, flattened, prismatic crystals, not altered by exposure to air, but turning yellow on exposure to light; odorless; nearly tasteless when first placed in the mouth, but afterward bitter; neutral reaction.

Preparation.—Santonin may be made by exhausting santonica mixed with lime with diluted alcohol, distilling off the alcohol and adding acetic acid to the residue. The precipitated santonin is purified by dissolving it in alcohol, treating with animal charcoal, and crystallizing.

Official Preparation.—Trochisci Santonini. (½ gr. S. in each.)

PICROTOXINUM, U. S.—Picrotoxin. $C_{30}H_{34}O_{13}$; 600.58.—A neutral principle prepared from the seeds of *Anamirta paniculata*, occurring in the form of colorless, flexible, shining, prismatic crystals, permanent in the air; odorless; very bitter taste; neutral reaction.

Preparation.—Picrotoxin is made from the kernel of cocculus indicus by treating an aqueous extract, which has been triturated with magnesia, with hot alcohol; the solution is evaporated, and the crystalline mass purified by recrystallization, after decolorizing with animal charcoal.

ERGOTA, U. S.—Ergot. (*Ergot of Rye.*)—The sclerotium of *Claviceps purpurea*, replacing the grain of *Secale cereale.*

Ergot should be only moderately dried. It should be preserved in a close vessel, and a few drops of chloroform should be dropped upon it from time to time, to prevent the development of insects. When more than one year old it is unfit for use.

Ergot owes its activity to *sclerotic acid*, *sclererythrin*, *scleromucin*, *scleroiodin*, and *picrosclerotin;* there is also present *scleroxanthin* and *sclerocrystallin*, with 25 per cent. of fixed oil, mycose, and protein compounds.

Official Preparations.—Extractum Ergotæ Fluidum, Extractum Ergotæ, Vinum Ergotæ.

GOSSYPII RADICIS CORTEX, U. S.—Cotton Root Bark.—The bark of the root of *Gossypium herbaceum* and of other species of *gossypium* contains a yellow resin, which becomes red upon exposure to air, fixed oil, tannin, starch, sugar, etc.

Official Preparation.—Extractum Gossypii Radicis Fluidum.

CROCUS, U. S.—Saffron.—The stigmas of *Crocus sativus* contain *polychroit*, $C_{48}H_{60}O_{18}$, a glucoside, which splits into *crocin* and glucose, volatile oil, wax, fixed oil, protein compounds, sugar, wax, etc.

Official Preparation.—Tinctura Croci.

SANTALUM RUBRUM, U. S.—Red Saunders.—The wood of *Pterocarpus santalinus* contains *santalic acid*, a resinous substance, *pterocarpin*, and *santol.*

RHUS TOXICODENDRON, U. S.—Rhus Toxicodendron. (*Poison Ivy.*)—The fresh leaves of *Rhus radicans* contain *toxicodendric acid*, fixed oil, tannin, mucilage, wax, etc.

Drugs Containing Saponified Principles, with their Preparations.

QUILLAJA, U. S.—Quillaja. (*Quillaia, Pharm. 1880. Soap Bark.*)—The bark of *Quillaja Saponaria* owes its action to a peculiar principle, *saponin*, $C_{32}H_{54}O_{18}$, a glucoside, splitting upon heating with dilute acid, into *sapogenin* and sugar.

Official Preparation.—Tinctura Quillajæ.

SARSAPARILLA, U. S.—Sarsaparilla.—The root of *Smilax officinalis*, *Smilax medica*, *Smilax papyraceæ*, and of other undetermined species of *Smilax*, contains a glucoside analogous to, if not identical with, saponin, termed *parillin.* When boiled with dilute acids, it splits into *parigenin* and grape sugar.

Official Preparations.—Decoctum Sarsaparillæ Compositum, Extractum Sarsaparillæ Fluidum, Extractum Sarsaparillæ Compositum Fluidum, Syrupus Sarsaparillæ Compositus.

SENEGA, U. S.—Senega.—The root of *Polygala senega.* Senega contains *polygallic acid* (sometimes called *senegin*), fixed oil, pectose, etc. Polygallic acid is analogous to, if not identical with, saponin. Liquid preparations of senega are very apt to gelatinize, owing to the presence of pectin; this is obviated by using water of ammonia or other alkali, to dissolve it.

Official Preparations.—Extractum Senegæ Fluidum, Syrupus Senegæ.

CAULOPHYLLUM, U. S.—Caulophyllum. (*Blue Cohosh.*)—The rhizome and rootlets of *Caulophyllum thalictroides* contain *saponin*, associated with resin, starch, albumin, coloring matter, extractive, etc.

Drugs Containing Cathartic Principles, and their Preparations.

SENNA, U. S.—Senna.—The leaflets of *Cassia acutifolia* (Alexandria Senna), and of *Cassia elongata* (India Senna), contain cathartic acid, which, under the influence of dilute acids and heat, splits into cathartogenic acid and glucose; there are also present phæoretin, sennacrol, cathartomannit, crysophan, mucilage, etc. Cathartic acid is believed to be the chief purgative principle, although several of the others possess cathartic properties.

Official Preparations.—Extractum Sennæ Fluidum, Infusum Sennæ Compositum, Syrupus Sennæ, Confectio Sennæ.

TAMARINDUS, U. S.—Tamarind.—The preserved pulp of the fruit of *Tamarindus indica.*

CASSIA FISTULA, U. S.—Cassia Fistula. (*Purging Cassia.*)—The fruit of *Cassia fistula* yields about 25 per cent. of pulp, which contains pectin, sugar, albuminous principles, salts, etc.

FICUS, U. S.—Fig.—The fleshy receptacle of *Ficus carica*, bearing fruit upon its inner surface.

PRUNUM, U. S.—Prune.—The fruit of *Prunus domestica* contains sugar, malic acid, pectin, salts, etc.

RHEUM, U. S.—Rhubarb.—The root of *Rheum officinale.* Rhubarb contains four resins, which are cathartic in their properties—*erythroretin*, *phæoretin*, *aporetin*, *emodin.* There are also present chrysophan and chrysophanic acid, both yellow, the former yielding the latter and glucose when treated with diluted acids. The astringent properties of rhubarb are due to *rheotannic acid*, $C_{26}H_{26}O_{14}$; *rheumic acid*, $C_{20}H_{16}O_{9}$, and calcium oxalate are also present.

Official Preparations.—Extractum Rhei, Extractum Rhei Fluidum, Tinctura Rhei, Tinctura Rhei Aromatica, Tinctura Rhei Dulcis, Syrupus Rhei, Syrupus Rhei Aromaticus, Mistura Rhei et Sodæ, Pulvis Rhei Compositus, Pilulæ Rhei, Pilulæ Rhei Compositæ.

CHRYSAROBINUM, U. S.—Chrysarobin.—In its commercial, more or less impure form (commonly misnamed Chrysophanic Acid), extracted from Goa Powder, a substance found deposited in the wood of the trunk of *Andira araroba*. Chrysarobin is a pale, orange-yellow, crystalline powder, permanent in the air; odorless and tasteless; almost insoluble in water, only slightly soluble in alcohol, readily soluble in ether and boiling benzol.

Official Preparation.—Unguentum Chrysarobini.

KAMALA, U. S.—Kamala. (*Rottlera, Pharm. 1870.*)—The glands and hairs from the capsules of *Mallotus philippinensis* contain *rottlerin*, $C_{22}H_{20}O_6$, nearly 75 per cent. of resins soluble in alcohol, coloring matter, etc.

CAMBOGIA, U. S.—Gamboge. (*Gambogia, Pharm. 1870.*)—A gum-resin obtained from *Garcinia Hanburii;* contains about 75 per cent. of resin called *gambogic acid*.

JALAPA, U. S.—Jalap.—The tuberous root of *Ipomæa Jalapa* contains from 12 to 20 per cent. of resin, the greater part of which is *convolvulin*, $C_{62}H_{100}O_{32}$, a glucoside, insoluble in ether; there are also present gum, sugar, starch, etc.

Official Preparations.—Extractum Jalapæ, Pulvis Jalapæ Compositus, Resinæ Jalapæ.

SCAMMONIUM, U. S.—Scammony.—A resinous exudation from the root of *Convolvulus scammonia;* contains from 80 to 90 per cent. of resin having cathartic properties, called *scammonin*, $C_{34}H_{56}O_{16}$; this is identical with the jalapin obtained from Ipomœa orizabensis.

Official Preparation.—Resina Scammonii.

PODOPHYLLUM, U. S.—Podophyllum. (*May Apple.*)—The rhizome and rootlets of *Podophyllum peltatum* contains *picropodophyllin*, *podophyllotoxin*, and *podophyllinic acid*.

Official Preparations.—Extractum Podophylli, Extractum Podophylli Fluidum, Resina Podophylli.

LEPTANDRA, U. S.—Leptandra. (*Culver's Root.*)—The rhizome and rootlets of *Veronica virginica* contain a crystalline principle, *leptandrin*, resin, tannin, saponin, gum, mannit, etc.

Official Preparations.—Extractum Leptandræ, Extractum Leptandræ Fluidum.

FRANGULA, U. S.—Frangula.—The bark of *Rhamnus frangula*, collected at least one year before being used, contains *frangulin*, $C_{20}H_{20}O_{10}$, sometimes called *rhamnoxanthin*, and emodin; both are glucosides.

Official Preparation.—Extractum Frangulæ Fluidum.

RHAMNUS PURSHIANA, U. S.—Cascara Sagrada.—The bark of Rhamnus Purshiana.

Official Preparation.—Extractum Rhamni Purshianæ Fluidum.

RUMEX, U. S.—Rumex. (*Yellow Dock.*)—The root of *Rumex crispus*, and of other species of *rumex*, contains chrysophanic acid (rumicin, lapathin), mucilage, tannin, starch, calcium oxalate, gum, coloring matter, etc.

Official Preparation.—Extractum Rumicis Fluidum.

JUGLANS, U. S.—Juglans. (*Butternut.*)—The inner bark of the root of *Juglans cinerea*, collected in autumn. It contains *nucin*, $C_{36}H_{12}O_{10}$, fixed oil, volatile oil, tannin, etc.

Official Preparation.—Extractum Juglandis.

EUONYMUS, U. S.—Euonymus. (*Wahoo.*)—The bark of *Euonymus atropurpureus* contains resins, a bitter principle called *euonymin*, *euonic acid*, starch, asparagin, and pectin.

Official Preparation.—Extractum Euonymi.

ALOE SOCOTRINA, U. S.—Socotrine Aloes.—The inspissated juice of the leaves of *Aloe Perryi* contains *aloin*, a trace of volatile oil, and a substance which has been improperly called resin. The aloin present in official aloes is *socaloin*, $C_{15}H_{16}O_7$. This may be distinguished from nataloin and barbaloin by Histed's Test.*

Official Preparations.—Extractum Aloes, Aloe Purificata.

ALOE BARBADENSIS.—Barbadoes Aloes.—The inspissated juice of the leaves of *Aloe vera*.

ALOE PURIFICATA, U. S.—Purified Aloes.—It occurs in irregular, brittle pieces, of a dull brown or reddish-brown color, and having the peculiar odor of Socotrine aloes. It is purified by melting, adding alcohol, to reduce its consistency, and straining off the impurities, sand, earth, chips, etc., evaporating, and, when cool, breaking the brittle mass into pieces of a convenient size.

Official Preparations.—Tinctura Aloes, Tinctura Aloes et Myrrhæ, Pilulæ Aloes, Pilulæ Aloes et Asafœtidæ, Pilulæ Aloes et Ferri, Pilulæ Aloes et Mastiches, Pilulæ Aloes et Myrrhæ.

ALOINUM, U. S.—Aloin.—A neutral principle obtained from several varieties of aloes, chiefly Barbadoes aloes (yielding Barbaloin); and Socotra or Zanzibar aloes (yielding Socaloin), differing more or less in chemical composition and physical properties according to the source from which it is derived. Minute acicular crystals, or a microcrystalline powder, varying in color from yellow to yellowish-brown, odorless or possessing a slight odor of aloes, of a characteristic, bitter taste, and permanent in the air.

Barbaloin is soluble, at 15° C. (59° F.), in about 60 parts of water, 20 parts of alcohol, or 470 of ether.

Socaloin is soluble in about 60 parts of water, 30 parts of absolute alcohol, 380 parts of ether, or 9 parts of acetic ether.

COLOCYNTHIS, U. S.—Colocynth.—The fruit of *Citrullus colocynthis*, deprived of its rind, contains *colocynthin*, *colocynthitin*, gum, resin, etc. Colocynthin is a very bitter glucoside, splitting, under the action of diluted acids, into colocynthein and grape sugar.

Official Preparations.—Extractum Colocynthidis, Extractum Colocynthidis Compositum.

ELATERINUM, U. S.—Elaterin. $C_{20}H_{28}O_5$; 347.20.—Minute, white, hexagonal scales or prisms, permanent in the air; odorless; having a bitter, somewhat acrid taste, and a neutral reaction. Prepared from elaterium, a sediment deposited by the juice of the fruit of the squirting cucumber, *Ecballium elaterium*, by exhausting with alcohol, evaporating to the consistency of a thin oil, and throwing the residue, while yet warm, into a weak boiling solution of potassa, by which the green resin is held in solution, and the elaterin crystallizes out when the liquor cools. Or it may be made by exhausting elaterium with chloroform, and precipitating the elaterin from the chloroform solution by ether.

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* See Remington's "Practice of Pharmacy."

Official Preparation.—Trituratio Elaterini.

BRYONIA, U. S.—Bryonia. (*Bryony.*)—The root of *Bryonia alba* and of *Bryonia dioica* contains bryonin, a bitter glucoside, soluble in alcohol and in water, starch, sugar, resin, etc.

Official Preparation.—Tinctura Bryoniæ.

Drugs Containing Astringent Principles, and their Preparations.

GALLA, U. S.—Nutgall.—Excrescences on *Quercus lusitanica*, caused by the punctures and deposited ova of *Cynips Gallæ tinctoriæ.* (Class insecta; order Hymenoptera). Nutgall contains about 50 per cent. of tannin, 2 per cent. of gallic acid, sugar, gum, resin, and starch.

Official Preparations.—Tinctura Gallæ, Unguentum Gallæ.

ACIDUM TANNICUM, U.S.—Tannic Acid. $HC_{14}H_9O_9$; 321.22 (*Gallotannic Acid, Digallic Acid.*)—An organic acid obtained from nutgall. A light yellowish, amorphous powder, usually cohering in form of glistening scales or spongy masses; gradually darkens on exposure to air and light; faint, peculiar odor; strongly astringent taste; acid reaction. Prepared by exposing nutgall, in fine powder, to a damp atmosphere for twenty-four hours, making into a paste with ether, setting the paste aside, covered closely, for six hours, then expressing it powerfully between tinned plates, so as to obtain the liquid portion. The resulting cake is again made into a paste with ether and water, and expressed as before, after which the liquids are mixed and evaporated spontaneously to a syrupy consistence, then spread on glass or tin plates, and dried quickly in a drying closet. Water and ether form a soluble compound with the tannic acid, and the expression separates it from the paste, after which the ether and water are driven off by the heat. Tannic acid, chemically, is an anhydride of gallic acid:—

$$\underset{\text{Gallic Acid.}}{2C_7H_6O_5} - \underset{\text{Water.}}{H_2O} = \underset{\text{Tannic Acid.}}{C_{14}H_{10}O_9}.$$

Official Preparations.—Glyceritum Acidi Tannici, Unguentum Acidi Tannici, Trochisci Acidi Tannici.

ACIDUM GALLICUM, U. S.—Gallic Acid. $HC_7H_6O_5.H_2O$; 187.55—An organic acid usually prepared from Tannic Acid. White or pale fawn-colored solid, crystallizing from water in long, silky, interlaced needles or triclinic prisms, permanent in the air; odorless; astringent and slightly acidulous taste; acid reaction. Prepared by macerating nutgalls (powdered and made into a paste) with water, for a month, expressing, rejecting the expressed liquor, boiling the residue in water, filtering, while hot, through animal charcoal, and crystallizing. The tannic acid of the galls is converted into gallic acid through the continued maceration with water:—

$$\underset{\text{Tannic Acid.}}{C_{14}H_{10}O_9} + \underset{\text{Water.}}{H_2O} = \underset{\text{Gallic Acid.}}{2C_7H_6O_5}.$$

PYROGALLOL, U. S.—Pyrogallol. (*Pyrogallic Acid.*)—A triatomic phenol obtained chiefly by the dry distillation of gallic acid. Light, white, shining laminæ, or fine needles, odorless, and having a bitter taste; acquiring a gray or darker tint on exposure to air and light. Soluble, at 15° C. (59° F.), in 1.7 parts of water, and in 1 part of alcohol; very soluble in boiling water and in boiling alcohol; also soluble in 1.2 parts of ether.

When gallic acid is sublimed, the heat converts it into pyrogallic acid and carbon dioxide:—

$$\underset{\text{Gallic Acid.}}{C_7H_6O_5} = \underset{\text{Pyrogallic Acid.}}{C_6H_6O_3} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

CATECHU, U. S.—Catechu.—An extract prepared from the wood of *Acacia catechu;* contains catechutannic acid, a peculiar form of tannin, which is insoluble in ether, and turns greenish-black with ferric salts. *Catechin* and *catechol* are also present. Owing to the decomposition of the tannic acid, the liquid preparations often gelatinize.

Official Preparations.—Tinctura Catechu Composita, Trochisci Catechu.

KINO, U. S.— Kino.—The inspissated juice of *Pterocarpus marsupium* contains kino-tannic acid, pyrocatechin, kino red, kinoin, gum, etc. Owing to the decomposition of the kino-tannic acid, the liquid preparations frequently gelatinize.

Official Preparation.—Tinctura Kino.

HÆMATOXYLON, U. S.—Hæmatoxylon. (*Logwood.*)—The heart-wood of *Hæmatoxylon campechianum* contains a colorless, sweet principle, *hæmatoxylin*, $C_{16}H_{14}O_6$, which is reddened upon exposure to light, and turned blackish-purple upon contact with alkalies, yielding *hæmatëin*, $C_{16}H_{12}O_6.H_2O$; it also contains tannin, resin, etc.

Official Preparation.—Extractum Hæmatoxyli.

KRAMERIA, U. S.—Krameria. (*Rhatany.*)—The root of *Krameria triandra*, and of *Krameria Ixina*, contains about 18 per cent. of kramerotannic acid, starch, gum, rhatannic red, etc.

Official Preparations.—Extractum Krameriæ, Extractum Krameriæ Fluidum, Tinctura Krameriæ.

QUERCUS ALBA, U. S.—White Oak.—The bark of *Quercus alba* contains about 10 per cent. of tannic acid, with pectin, resin, and brownish-red coloring matter.

ROSA GALLICA, U. S.—Red Rose.—The petals of *Rosa gallica*, collected before expanding. It contains *quercitrin* and *quercitannic acid;* the pale red coloring matter is made bright red by the addition of sulphuric acid.

Official Preparations.—Extractum Rosæ Fluidum, Mel Rosæ, Confectio Rosæ.

ROSA CENTIFOLIA, U. S.—Pale Rose.—The petals of *Rosa centifolia* contain a little tannin, volatile oil, sugar, mucilage

OLEUM ROSÆ, U. S.—Oil of Rose.—A volatile o the fresh flowers of *Rosa damascena*. It is a pale-yello liquid, having a strong odor of rose; a sweetish, rather slightly acid reaction; sp. gr. about 0.860.

RHUS GLABRA, U. S.—Rhus Glabra.—The fruit of *Rhus Glabra.*

RUBUS, U. S.—Rubus. (*Blackberry.*)—The bark of the root of *Rubus villosus*, *Rubus canadensis*, and *Rubus trivialis*, owes its astringent properties to tannic acid.

Official Preparation.—Extractum Rubi Fluidum.

GERANIUM, U. S.—Geranium. (*Cranesbill.*)—The rhizome of *Geranium maculatum* contains about 15 per cent. of tannic acid, with brownish-red coloring matter, starch, sugar, pectin, etc.

Official Preparation.—Extractum Geranii Fluidum.

HAMAMELIS, U. S.—Hamamelis. (*Witchhazel.*)—The leaves of *Hamamelis virginica*, collected in autumn, contain tannic acid, chlorophyl, bitter principle, mucilage, etc.

Official Preparation.—Extractum Hamamelidis Fluidum.

CHIMAPHILA, U. S.—Chimaphila. (*Pipsissewa.*)—The leaves of *Chimaphila umbellata* contain about 5 per cent. of tannic acid, with *chimaphilin*, *ericolin*, *arbutin*, *urson*, sugar, gum, etc.

Official Preparation.—Extractum Chimaphila Fluidum.

UVA URSI, U. S.—Uva Ursi. (*Bearberry.*)—The leaves of *Arctostaphylos uva ursi* contain about 6 per cent. of tannic acid, with gallic acid, *urson*, *arbutin*, *ericolin*, gum, resin, coloring matter, etc.

Official Preparations.—Extractum Uvæ Ursi Fluidum, Extractum Uvæ Ursi.

CASTANEA, U. S.—Castanea. (*Chestnut.*)—The leaves of *Castanea dentata*, collected in September or October, while still green. Chestnut leaves contain tannic acid, mucilage, etc.

Official Preparation.—Extractum Castaneæ Fluidum.

SALVIA, U. S.—Salvia. (*Sage.*)—The leaves of *Salvia officinalis.*

ALKALOIDS.

Into what two General Divisions are Alkaloids Divided Chemically? AMIDES—Composed of C H N and O; AMINES—Composed of C H and N (oxygen wanting).

What is the Source of Alkaloids? They are found in both the animal and vegetable kingdoms.

What are their Distinctive Features? First, they all contain N. The non-volatile alkaloids (amides) are solid; the volatile alkaloids (amines) are liquid. Second, they restore the color of reddened litmus, combine with acids to form salts, and are precipitated from their saline solutions by alkalies. Third, they are generally the active principles of the plants in which they reside, are mostly poisonous, and have a bitter, acrid, or pungent taste. Fourth, they are mostly crystallizable and colorless, insoluble in H_2O, soluble in alcohol, chloroform, benzin, benzol, and some in ether. Their salts, however, are mostly soluble in H_2O, less so in alcohol; insoluble in chloroform, ether, benzin, and benzol. Fifth, they are mostly precipitated by one or more of the following reagents: *Potassio-mercuric iodide, auric chloride, tannic acid, phospho-molybdic acid,* and *picric acid.*

What Nomenclature has been adopted for the Alkaloids? The last syllable should terminate in *ine;* the Latin termination is *ina;* the names of neutral principles and glucosides end in *in.*

OPIUM, U. S.—Opium.—The concrete, milky exudation obtained by incising the unripe capsules of *Papaver somniferum*, and yielding, in its normal moist condition, not less than 9 per cent. of morphine when assayed.

What two Acids are found in Opium combined with the Alkaloids? Meconic and lactic acids.

How many Alkaloids does Opium contain? Nineteen, of which the most important is morphine.

OPII PULVIS, U. S.—Powdered Opium.—Opium dried at a temperature not exceeding 85° C. (185° F.), and reduced to a very fine (No. 80) powder. Should yield not less than 13 nor more than 15 per cent. of crystallized morphine.

OPIUM DEODORATUM, U. S.—Deodorized Opium. (*Opium Denarcotisatum, Pharm. 1880.*)—Opium from which the narcotine has been extracted with stronger ether, mixed with sugar of milk, and containing 14 per cent. of morphine.

Official Preparation.—Pulvis Opii.

Official Preparations of Powdered Opium.—Opium Deodoratum, Acetum Opii, Extractum Opii, Tinctura Opii, Tinctura Opii Deodorati, Tinctura Opii Camphorata, Vinum Opii, Pilulæ Opii, Pulvis Ipecacuanhæ et Opii, Trochisci Glycyrrhizæ et Opii.

Official Preparation of Extract of Opium.—Emplastrum Opii.

MORPHINA, U. S.—Morphine. $C_{17}H_{19}NO_3 + H_2O$; 302.34.—An alkaloid obtained from Opium. Colorless or white, shining, prismatic crystals, or fine needles, or a crystalline powder, permanent in the air; odorless; bitter taste; alkaline reaction. Prepared from an aqueous solution of opium containing the alkaloid in combination with meconic and lactic acids, by treating it with alcohol and water of ammonia—the former retaining the coloring matter, caoutchouc, resins, etc., in solution, while the latter sets free the morphine, by combining with the natural acids. The alkaloid is then purified by dissolving in boiling alcohol, filtering through animal charcoal, and crystallizing.

MORPHINÆ ACETAS, U. S.—Morphine Acetate. $C_{17}H_{19}NO_3C_2H_4O_2 + 3H_2O$; 398.12.—A white or faintly yellowish-white crystalline or amorphous powder, slowly losing acetic acid when exposed to the air; having a faintly acetous odor, a bitter taste, and a neutral or faintly alkaline reaction. Prepared by acting on morphine with acetic acid.

MORPHINÆ HYDROCHLORAS, U. S.—Morphine Hydrochlorate. $C_{17}H_{19}NO_3HCl + 3H_2O$; 374.63.—White, feathery needles, of a silky lustre, or minute, colorless, needle-shaped crystals; permanent in the air; odorless; bitter taste; neutral reaction. Made by acting on morphine with hydrochloric acid.

MORPHINÆ SULPHAS, U. S.—Morphine Sulphate. $(C_{17}H_{19}NO_3)_2H_2SO_4 + 5H_2O$; 756.38.—White, feath [illegible] silky lustre, permanent in the air; odorless; [illegible] Prepared by acting on morphine with sulphu [illegible]

Official Preparations.—Pulvis Morphinæ [illegible] phinæ et Ipecacuanhæ.

CODEINA, U.S.—Codeine. (*Codeia.*) $C_{18}H_{21}NO_3 + H_2O$; 316.31.—An alkaloid prepared from opium, occurring in the form of white, more or less translucent, orthorhombic prisms, or octohedral crystals; somewhat efflorescent in warm air; odorless; slightly bitter taste; alkaline reaction. Prepared by precipitating the hydrochlorates of morphine and codeine with ammonia, codeine remaining in solution, and afterward obtained by evaporation, crystallization, and purifying by dissolving in hot ether, and evaporating spontaneously.

APOMORPHINÆ HYDROCHLORAS, U. S.—Apomorphine Hydrochlorate. $C_{17}H_{17}NO_2HCl$; 302.79.—The hydrochlorate of an artificial alkaloid prepared from morphine or codeine, occurring in the form of minute, grayish-white, shining acicular crystals, turning greenish on exposure to light and air; odorless; bitter taste; neutral or faintly acid reaction. Prepared by heating morphine in a closed tube, with a great excess of hydrochloric acid, for two or three hours, to the temperature of 140° to 150° C. (284°–302° F.), dissolving the contents of the tube in water, adding an excess of $NaHCO_3$, and exhausting the precipitate with ether or chloroform; the addition of HCl now results in crystals of the salt. The rationale of the process is one of dehydration; the morphine parts with one molecule of water.

CINCHONA, U. S.—Cinchona.—The bark of *Cinchona Calisaya, Cinchona officinalis*, and of hybrids of these and of other species of *Cinchona*, yielding, when assayed by the U. S. P. process, not less than 5 per cent. of total alkaloids, and at least 2.5 per cent. of quinine ($C_{20}H_{24}N_2O_2 + H_2O$; 341.3).

CINCHONA RUBRA, U. S.—Red Cinchona. (*Red Bark.*)—The bark of the trunk of *Cinchona succirubra*, containing at least 5 per cent. of quinine.

Cinchona barks are assayed, first, for total alkaloids; second, for quinine, by a process directed in the U. S. P. (which see). About twenty alkaloids have been discovered in cinchona bark. Some of these are found only in one kind of bark; some are, doubtless, "split products" (alkaloids not existing naturally in the bark, but the result of the action of chemical agents upon it). The most important alkaloids found in cinchona are *quinine, quinidine, cinchonine*, and *cinchonidine*. The acids present are *kinic* or *quinic, cinchotannic*, and *kinovic* or *quinovic*. The neutral principle is *kinovin* or *quinovin; cinchonic red*, volatile oil, and red and yellow coloring matters are also present.

Official Preparations.—Infusum Cinchonæ, Extractum Cinchonæ, Extractum Cinchonæ Fluidum, Tinctura Cinchonæ, Tinctura Cinchonæ Compositæ.

QUININA, U. S.—Quinine. $C_{20}H_{24}N_2O_2 + 3H_2O$ (crystallized); 377.22.—An alkaloid obtained from the bark of various species of cinchona. Quinine occurs in the form of a white, flaky, amorphous, or minutely crystalline powder, permanent in the air. It is odorless, has a very bitter taste and alkaline reaction. Prepared by adding to the acid soluti
sulphate, ammonia water or solution of soda, which precipitates
As quinine is soluble in alkalies, carefully avoid excess.

QUININÆ SULPHAS, U. S.—Quinine S
$N_2O_2)_2H_2SO_4.7H_2O$; 870.22.—White, silky, light ar

crystals, fragile and somewhat flexible, making a very light and easily compressible mass; lustreless from superficial efflorescence after standing in the air. The salt is liable to lose water on exposure to warm air, to absorb moisture in damp air, and to become colored by exposure to light. Odorless; persistent, very bitter taste; neutral reaction. Prepared by treating yellow cinchona bark with hydrochloric acid, which forms, with the alkaloids soluble hydrochlorates; decomposing with lime, which precipitates the alkaloid; dissolving out the alkaloid from the excess of lime with boiling alcohol; evaporating; acidulating with sulphuric acid, which forms the sulphate, then purifying with the animal charcoal, and crystallizing.

QUININÆ BISULPHAS, U. S.—Quinine Bisulphate. $C_{20}H_{24}N_2O_2H_2SO_4 + 7H_2O$; 546.88.—Colorless, transparent, or whitish orthorhombic crystals, efflorescing on exposure to air; odorless; very bitter taste; strongly acid reaction. Prepared by acting on quinine sulphate by sulphuric acid. The bisulphate of quinine contains 13 per cent. less alkaloid than the sulphate.

QUININÆ HYDROCHLORAS, U. S.—Quinine Hydrochlorate. $C_{20}H_{24}N_2O_2HCl + 2H_2O$; 395.63.—White, silky, light and fine needle-shaped crystals. The salt is liable to lose water when exposed to warm air. When heated to 120° C. (248° F.) the salt loses its water of crystallization. Odorless, very bitter taste; neutral or faintly alkaline reaction. Prepared by double decomposition between quinine sulphate and barium chloride, or by dissolving the alkaloid in dilute HCl, evaporating, and crystallizing.

QUININÆ HYDROBROMAS, U. S.—Quinine Hydrobromate. $C_{20}H_{24}N_2O_2HBr + 2H_2O$; 422.06.—White, light, silky needles. The salt is liable to lose water on exposure to warm or dry air; odorless; very bitter taste; neutral or slightly alkaline reaction. Prepared by decomposing quinine sulphate in alcohol, with potassium bromide, in water. K_2SO_4 crystallizes out, and the hydrobromate may be obtained by evaporating and crystallizing. Quinine hydrobromate may also be made by double decomposition between quinine sulphate and barium bromide, or by dissolving the alkaloids in hot dilute hydrobromic acid.

QUININÆ VALERIANAS, U. S.—Quinine Valerianate. $C_{20}H_{24}N_2O_2C_5H_{10}O_2 + H_2O$; 443.07.—White or nearly white, pearly, lustrous, triclinic crystals, permanent in the air and slight odor of valerianic acid; bitter taste; neutral or slightly alkaline reaction. Prepared by decomposing the sulphate by AmHO, and combining it with valerianic acid. (Hot solutions are used and the valerianate crystallizes on cooling.)

QUINIDINÆ SULPHAS, U. S.—Quinidine Sulphate. $(C_{20}H_{24}N_2O_2)_2H_2SO_4 + 2H_2O$; 780.42.—A salt of an alkaloid of cinchona, obtained from the mother-liquors obtained after the crystallization of quinine, occurring in the form of white, silky needles, permanent in the air; odorless; very bitter taste; neutral or faintly alkaline reaction, and differing from quinine in being dextrogyre (quinine is lævogyre) and being almost

or

U. S.—Cinchonine. $C_{19}H_{22}N_2O$; 293.41. An

hich may be obtained from the mother-waters of

ng them with water, precipitating with AmHO, washing and drying, and then dissolving in boiling alcohol, which deposits the cinchonine in a crystalline form upon cooling. It may be purified still further by re-crystallization. It occurs in the form of white, lustrous prisms or needles, permanent in the air; odorless; at first nearly tasteless, but developing a bitter after-taste; alkaline reaction.

CINCHONINÆ SULPHAS, U. S.—Cinchonine Sulphate. $(C_{19}H_{22}N_2O)_2H_2SO_4 + 2H_2O$; 720.56.—Hard, white, lustrous, prismatic crystals, permanent in the air; odorless; very bitter taste; neutral reaction. Prepared from quinine mother-liquors by precipitating with soda, and converting into a sulphate by H_2SO_4, decolorizing and crystallizing.

CINCHONIDINÆ SULPHAS, U. S.—Cinchonidine Sulphate. $(C_{19}H_{22}N_2O)_2H_2SO_4 + 3H_2O$; 738.52.—A neutral sulphate of an alkaloid of cinchona, obtained from quinine mother-liquors by a fractional crystallization, and occurring in the form of white, silky, acicular crystals, slightly efflorescent on exposure to the air; odorless; very bitter taste; neutral or faintly alkaline reaction.

NUX VOMICA, U. S.—Nux Vomica.—The seed of *Strychnos Nux-vomica.* It contains strychnine, brucine $(C_{23}H_{26}N_2O_4)$, probably loganin, igasuric acid, protein compounds, gum, fixed oil, sugar, etc. It owes its activity principally to strychnine.

Official Preparations.—Extractum Nucis Vomicæ, Extractum Nucis Vomicæ Fluidum, Tinctura Nucis Vomicæ.

STRYCHNINA, U. S.—Strychnine. $C_{21}H_{22}N_2O_2$; 333.31.—An alkaloid obtained from nux vomica, and also obtainable from other plants of the natural order *Loganiaceæ.* Colorless, transparent, octahedral or prismatic crystals, or a white, crystalline powder, permanent in the air; odorless; intensely bitter taste, which is still perceptible in a highly dilute (one in 700,000) solution; alkaline reaction. Prepared by treating nux vomica with hydrochloric acid, decomposing with lime, dissolving out from the excess of lime with boiling alcohol (the brucine having been previously removed by treatment with diluted alcohol), evaporating the alcoholic solution, acidulating with H_2SO_4, to form a sulphate, decolorizing and crystallizing, then dissolving the crystals and precipitating the alkaloid by ammonia water.

STRYCHNINÆ SULPHAS, U. S.—Strychnine Sulphate. $(C_{21}H_{22}N_2O_2)_2H_2SO_4 + 5H_2O$; 854.24.—Colorless or white, prismatic crystals, efflorescent in dry air; odorless; intensely bitter taste, which is still perceptible in a highly dilute (one in 700,000) solution; neutral reaction. Prepared during the process for making strychnine, and much more soluble than the latter.

COCA, U. S.—Coca. (*Erythroxylon, Pharm. 1880.*)—The leaves of *Erythroxylon Coca* contain *cocaine*, $C_{17}H_{21}NO_4$, and *hygrine*, combined with cocatannic acid

Official Preparation.—Extractum Cocæ Fluidum.

COCAINÆ HYDROCHLORAS, U. S.—Cocaine Hydrochlorate. $C_{17}H_{21}NO_4HCl$; 338.71.—This hydrochloride is an alkaloid obtained from coca. Colorless, transparent crystals, or a white, crystalli powder, permanent in the air. Odorless, saline, slightly bitter taste ducing upon the tongue a tingling sensation, followed by numbness of some minutes' duration; neutral reaction.

GELSEMIUM, U. S.—Gelsemium. (*Yellow Jasmine.*)—The rhizome and rootlets of *Gelsemium sempervirens* contains *gelsemine*, $C_{11}H_{12}NO_2$, gelseminic acid, volatile oil, starch, resin, fat, coloring matter, etc.

Official Preparations.—Extractum Gelsemii Fluidum, Tinctura Gelsemii.

PHYSOSTIGMA, U. S.—Physostigma. (*Calabar Bean.*)—The seed of *Physostigma venenosum* containing *physostigmine* or *eserine*, $C_{15}H_{21}N_3O_2$, an alkaloid, amorphous and without taste; also *calabarine*, an alkaloid derived from eserine; and a neutral principle, *physosterin*; also starch, protein compounds, mucilage, etc.

Official Preparations.—Extractum Physostigmatis, Tinctura Physostigmatis.

PHYSOSTIGMINÆ SALICYLAS, U. S.—Physostigmine Salicylate. $C_{15}H_{21}N_3O_2C_7H_6O_3$; 412.17.—Colorless, or faintly yellowish, shining, acicular, or short columnar crystals, gradually turning reddish when long exposed to air and light; odorless; bitter taste; neutral reaction. Prepared by adding 2 p. of physostigmine to a solution of 1 p. of salicylic acid in 35 p. boiling distilled water, and allowing the salt to crystallize on cooling.

PHYSOSTIGMINÆ SULPHAS, U. S.—Physostigmine Sulphate. $(C_{15}H_{21}N_3O_2)_2H_2SO_4$; 646.82. (*Eserine Sulphate.*)—The sulphate of an alkaloid obtained from Physostigma. A white or yellowish-white, micro-crystalline, very deliquescent powder, odorless, and having a bitter taste.

BELLADONNÆ FOLIA, U. S.—Belladonna Leaves.—The leaves of *Atropa Belladonna.*

BELLADONNÆ RADIX, U. S.—Belladonna Root.—The root of *Atropa Belladonna.* Belladonna owes its activity to *atropine*, $C_{17}H_{23}NO_3$, and a small quantity of *hyoscyamine*; it also contains *belladonnine.*

Official Preparations of the Leaves.—Extractum Belladonnæ Foliorum Alcoholicum, Tinctura Belladonnæ, Unguentum Belladonnæ.

Of the Root:—Extractum Belladonnæ Radicis Fluidum, Emplastrum Belladonnæ, Linimentum Belladonnæ.

ATROPINA, U. S.—Atropine. $C_{17}H_{23}NO_3$; 288.38.—An alkaloid obtained from Belladonna. As it occurs in commerce, it is always accompanied by a small proportion of hyoscyamine extracted along with it, from which it cannot be readily separated. White acicular crystals, or a more or less amorphous, white powder, and gradually assuming a yellowish tint on exposure to the air. Odorless; bitter and acrid taste; alkaline reaction. Prepared by treating a concentrated alcoholic tincture of the root with H_2SO_4, to convert the atropine into sulphate, distilling off the alcohol, adding water to the residuary liquid, filtering, to separate oil and resin, treating the filtrate with potassium hydrate and chloroform—the former to decompo[illegible] rating the latter to obtain the alkaloid [illegible]

[illegible] **ate.** $(C_{17}H_{23}$-

$NO_3)_2H_2SO_4$; 674.58.—A white, indistinctly crystalline powder, permanent in the air; odorless; very bitter, nauseating taste; neutral reaction. Prepared by treating the alkaloid with dilute sulphuric acid, and evaporating at a temperature not exceeding 37.7° C. (100° F.)

HYOSCYAMUS, U. S.—Hyoscyamus. (*Henbane.*)—The leaves of *Hyoscyamus nigra*, collected from plants of the second year's growth and containing hyoscyamine, $C_{17}H_{23}NO_3$; hyoscine, $C_{17}H_{23}NO_3$; hyoscypicrin, $C_{27}H_{52}O_{14}$; chlorophyl, mucilage, extractive matter, etc.

Official Preparations.—Extractum Hyoscyami Alcoholicum, Extractum Hyoscyami Fluidum, Tinctura Hyoscyami.

HYOSCINÆ HYDROBROMAS, U. S.—Hyoscine Hydrobromate. $C_{17}H_{21}NO_4HBr + 3H_2O$; 436.98.—The hydrobromate of an alkaloid obtained from hyoscyamus; occurring in colorless, transparent, rhombic crystals; odorless, and having an acrid, slightly bitter taste; permanent in the air; soluble at 15° C (59° F) in 1.9 p. of water, and in 13 p. alcohol; very slightly soluble in ether and chloroform. It should be kept in small, well-stoppered vials.

HYOSCYAMINÆ HYDROBROMAS, U. S.—Hyoscyamine Hydrobromate. $C_{17}H_{23}NO_3HBr$; 369.14.—The hydrobromate of an alkaloid obtained from Hyoscyamus; occurring as a yellowish-white, amorphous, resin-like mass, or prismatic crystals, deliquescent on exposure to the air, having—particularly when damp—a tobacco-like odor, and an acrid, nauseous, and bitter taste; neutral reaction. Soluble at 15° C. (59° F.) in about 0.3 p. of water, 2 p. alcohol, 3000 p. of ether, or 250 p. of chloroform.

HYOSCYAMINÆ SULPHAS, U. S.—Hyoscyamine Sulphate. $(C_{17}H_{23}NO_3)_2H_2SO_4$; 674.58.—A neutral sulphate of an alkaloid obtained from Hyoscyamus; white, indistinct crystals, or a white powder, deliquescent on exposure to damp air; odorless, having a bitter and acrid taste, and a neutral reaction. Prepared by heating an acidulated tincture of the seeds, after separating the fixed oil, with soda, precipitating with tannin, mixing the precipitate with lime, exhausting with alcohol, acidulating, concentrating, agitating with ether, to remove coloring matter and oil, afterward decolorizing and recrystallizing.

STRAMONII FOLIA, U. S.—Stramonium Leaves.—The leaves of *Datura stramonium.*

STRAMONII SEMEN, U. S.—Stramonium Seed.—The seed of *Datura stramonium.* Stramonium contains *daturine* (a mixture of hyoscyamine and atropine); the leaves also contain albumen, mucilage, and potassium nitrate, while in the seeds exist about 25 per cent. of fixed oil, with resin, mucilage, etc.

Official Preparations.—Extractum Stramonii Seminis, Extractum Stramonii Seminis Fluidum, Tinctura Stramonii Seminis, Unguentum Stramonii Seminis.

DULCAMARA, U. S.—Dulcamara. (*Bittersweet.*)—The young branches of *Solanum dulcamara*, containing solanine (alkaloid) and *dulcamarine*, $C_{22}H_{34}O_{10}$ (glucoside), (the latter is the bitter and sweet principle), gum, wax, fat, resin, etc.

Official Preparation.—Extractum Dulcamara Fluidum.

PILOCARPUS, U. S.—Pilocarpus. (*Jaborandi.*)—The leaflets of Pilocarpus Selloanus, and of P. Jaborandi, containing *pilocarpine*, $C_{11}H_{16}N_2O_2$, and volatile oil, consisting principally of *dipentene*, $C_{10}H_{16}$, a terpene.

Official Preparation.—Extractum Pilocarpi Fluidum.

PILOCARPINÆ HYDROCHLORAS, U. S.—Pilocarpine Hydrochlorate. $C_{11}H_{16}N_2O_2.HCl$; 243.98.—Minute, white crystals, deliquescent on exposure to damp air; odorless; faintly bitter taste; neutral reaction. Prepared by treating pilocarpine with dilute HCl, concentrating, and crystallizing.

COLCHICI RADIX, U. S.—Colchicum Root.—The corm of *Colchicum autumnale*.

COLCHICI SEMEN, U. S.—Colchicum Seed.—The seed of *Colchicum autumnale*. Colchicum contains the alkaloid *colchicine*, both in corm and seed. In the former there are present starch, gum, fat, sugar, resin, etc. In the latter a fixed oil is found in addition to the other principles. The alkaloid may be extracted by digesting the seeds in hot alcohol without powdering them.

Official Preparations.—Extractum Colchici Radicis, Extractum Colchici Radicis Fluidum, Vinum Colchici Radicis, Extractum Colchici Seminis Fluidum, Tinctura Colchici Seminis, Vinum Colchici Seminis.

VERATRUM VIRIDE, U. S.—Veratrum Viride. (*American hellebore.*)—The rhizome and rootlets of *Veratrum viride*, containing the alkaloids *jervine*, *veratroidine*, *pseudojervine*, and *rubijervine*, also resins, starch, coloring matter, etc.

Official Preparations.—Extractum Veratri Viridis Fluidum, Tinctura Veratri Viridis.

VERATRINA, U. S.—Veratrine.—An alkaloid or mixture of alkaloids, prepared from the seeds of *Asagræa officinalis*, occurring in the form of a white or grayish-white, amorphous, semi-crystalline powder, permanent in the air; odorless, but causing intense irritation and sneezing when even a minute quantity reaches the nasal mucous membrane; of acrid taste, leaving a sensation of tingling and numbness on the tongue; feebly alkaline reaction. Prepared by exhausting the seeds with alcohol, recovering the alcohol by distillation, diluting the residuary liquid, which contains veratrine in its neutral combination with veratric acid, with water, to precipitate the resin, filtering, adding potassa or ammonia to precipitate the alkaloid, redissolving, decolorizing, and reprecipitating.

Official Preparations.—Oleatum Veratrinæ, Unguentum Veratrinæ.

CHELIDONIUM, U. S.—Chelidonium. (*Celandine.*)—*Chelidonium majus* contains *chelerythrine*, *chelidonine*, $C_{19}H_{17}N_3O_3$, *chelidoxanthin*, and *chelidonic acid*.

SANGUINARIA, U.S.—Sanguinaria. (*Bloodroot.*)—The rhizome of *Sanguinaria canadensis*, collected in autumn and containing *sanguinarine*, $C_{19}H_{17}NO_4$; a colorless alkaloid, which yields bright red salts; another unnamed alkaloid; also malic and citric acid, starch, resins, coloring-matter, etc.

Official Preparations.—Extractum Sanguinariæ, Fluidum, Tinctura Sanguinariæ.

STAPHISAGRIA, U. S.—Staphisagria. (*Stavesacre.*)—The seed of *Delphinium Staphisagria*, containing three alkaloids, *delphinine*, *delphisine*, and *delphinoidine*, also, *staphisain*, with fixed oil, protein compounds etc.

ACONITUM, U. S.—Aconite.—The tuberous root of *Aconitum Napellus*, containing *aconitine*, $C_{33}H_{43}NO_{12}$; *isaconitine*, $C_{33}H_{43}NO_{12}$; *pseudaconitine*, $C_{36}H_{49}NO_{11}$. *Aconine*, $C_{26}H_{39}NO_{11}$; and *pseudaconine*, $C_{27}H_{41}NO_{8}$, are products of hydrolysis. *Aconitic acid*, $H_6C_6O_6$ is present together with resin, sugar, fat, coloring matter, etc. *Aconitic acid* may be produced by heating citric acid to 155° C. (311° F.).

Official Preparations.—Extractum Aconiti, Extractum Aconiti Fluidum, Tinctura Aconiti.

HYDRASTIS, U. S.—Hydrastis. (*Golden Seal.*)—The rhizome and rootlets of *Hydrastis canadensis*, containing *hydrastine*, $C_{22}H_{23}NO_6$; *berberine*, $C_{20}H_{17}NO_4$; xanthopuccine, sugar, starch, resin, coloring-matter, etc.

Official Preparations.—Extractum Hydrastis Fluidum, Tinctura Hydrastis, Glyceritum Hydrastis.

HYDRASTININÆ HYDROCHLORAS, U. S.—Hydrastinine Hydrochlorate. $C_{11}H_{11}NO_2HCl$; 224.97.—The hydrochlorate of an artificial alkaloid derived from hydrastine, the latter being a colorless alkaloid obtained from hydrastis. Light-yellow, amorphous granules, or a pale-yellow, crystalline powder; odorless, and having a bitter, saline taste; deliquescent on exposure to damp air; soluble at 15° C. (59° F.) in 0.3 part of water and in three parts of alcohol; difficultly soluble in ether or chloroform. Keep in well-stoppered vials.

MENISPERMUM, U. S.—Menispermum. (*Yellow Parilla, Canadian Moonseed.*)—The rhizome and rootlets of *Menispermum canadense*, containing *menispine*, *berberine*, resin, starch, tannin, coloring-matter, etc.

Official Preparation.—Extractum Menispermi Fluidum.

ASPIDOSPERMA, U. S.—Aspidosperma. (*Quebracho*)—The bark of Aspidosperma-blanco. Contains aspidospermine, aspidospermatine, aspidosamine, quebrachine, hypoquebrachine, and quebrachamine.

Official Preparation.—Extractum Aspidospermatis Fluidum.

GRANATUM, U. S.—Pomegranate.—The bark of the root of *Punica Granatum*, containing four alkaloids; *pelletierine*, *isopelletierine*, *methylpelletierine*, *pseudopelletierine*. The first three are liquid, the latter solid and crystalline. The drug also contains punico-tannic acid, $C_{20}H_{16}O_{13}$, sugar, mannit, pectin. gum, etc.

PAREIRA, U. S.—Pareira. (*Pareira Brava.*)—The root of *Chondodendron tomentosum*, containing *pelosine*, or *cissampeline*, which is identical with buxine and berberine, alkaloids obtained from Buxus semper virens and Nectandra Rodiæi.

Official Preparation.—Extractum Pareiræ Fluidum.

IPECACUANHA, U. S.—Ipecac.—The root of *Cephaelis Ipecacuanha*, containing emetine, $C_{28}H_{40}N_2O_5$, ipecacuanhic acid, pectin, starch, resin, sugar, etc.

Official Preparations.—Extractum Ipecacuanhæ Fluidum, Trochisci Ipecacuanhæ, Trochisci Morphinæ et Ipecacuanhæ, Syrupus Ipecacuanhæ, Tinctura Ipecacuanhæ et Opii, Vinum Ipecacuanhæ, Pulvis Ipecacuanhæ et Opii.

COCA, U. S.—Coca. (*Erythroxylon, Pharm. 1880.*)—The leaves of *Erythroxylon coca* contain *cocaine*, $C_{17}H_{21}NO_4$, and *hygrine* combined with cocatannic acid.

Official Preparation.—Extractum Cocæ Fluidum.

GUARANA, U. S.—Guarana.—A dried paste, consisting of the crushed or ground seeds of *Paullinia sorbilis*, containing *caffeine*, $C_8H_{10}N_4O_2$, about 25 per cent. of tannin, resin, mucilage, starch, volatile oil, saponin, etc.

Official Preparation.—Extractum Guaranæ Fluidum.

CAFFEINA, U. S.—Caffeine. $C_8H_{10}N_4O_2 + H_2O$; 211.68. (*Theine*).—A feeble basic proximate principle obtained from the dried leaves of *Thea sinensis*, or from the dried seeds of the *Coffea arabica*, and found also in other plants. Fleecy masses of flexible crystals, generally quite long, and of a silky lustre, odorless, bitter taste, neutral reaction, and permanent in the air. Obtained from a decoction of tea or coffee by precipitating with lead acetate, removing the lead by H_2S, adding NH_4HO, evaporating, and recrystallizing.

CAFFEINA CITRATA, U. S.—Citrated Caffeine.—A white powder; odorless; having a purely acid taste, and an acid reaction; prepared by adding caffeine to a solution of citric acid, evaporating and reducing the product to powder.

CAFFEINA CITRATA EFFERVESCENS, U. S.—Effervescent Citrated Caffeine.—An effervescing, coarse, granular powder, prepared by uniting together caffeine, citric acid, sodium bicarbonate, tartaric acid, and sugar, making a paste with alcohol, rubbing the same through a No. 6 tinned iron sieve or enameled colander, and drying the powder.

CONIUM, U. S.—Conium. (*Hemlock.*)—The full-grown fruit of *Conium maculatum*, gathered while yet green, and containing *conine*, $C_8H_{17}N$; *conhydrine*, $C_8H_{17}NO$; and *methylconine*, $C_8H_{16}CH_3N$; also a little volatile oil and fixed oil. Conium is a liquid volatile alkaloid, containing no oxygen, and with an odor resembling that of the urine of mice.

Official Preparations.—Extractum Conii, Extractum Conii Fluidum.

SCOPARIUS, U. S.—Scoparius. (*Broom.*)—The tops of *Cytisus scoparius.* Contains *sparteine*, a colorless liquid alkaloid which probably represents the diuretic and purgative action of the drug.

Official Preparation.—Extractum Scoparii Fluidum.

SPARTEINÆ SULPHAS, U. S.—Sparteine Sulphate. $C_{15}H_{26}N_2H_2SO_4 + 4H_2O$; 403.23.—The neutral sulphate of an alkaloid obtained from Scoparius; colorless, white, prismatic crystals, or a granular powder; odorless, and having a slightly saline and somewhat bitter taste. Liable to attract moisture when exposed to damp air. Very soluble in water and alcohol.

LOBELIA, U. S.—Lobelia.—The leaves and tops of *Lobelia* collected after a portion of the capsules have been inflated, *lobeline*, *lobelic acid*, *lobelacrin*, wax, resin, gum, etc. *Lobeline* is a liquid alkaloid, and contains no oxygen.

Official Preparations.—Extractum Lobeliæ Fluidum, Tinctura Lobeliæ.

TABACUM, U. S.—Tobacco.—The commercial dried leaves of *Nicotiana Tabacum*, containing nicotine, $C_{10}H_{14}N_2$, a liquid alkaloid, which is colorless, very acrid, poisonous, and rapidly turns brown on exposure to air; soluble in water, alcohol, and ether.

PRODUCTS FROM ANIMAL SUBSTANCES.

The animal products of pharmaceutical interest are not numerous, but some of them are very important. Their chemical composition is not very well understood.

Official Products Derived from the Class Mammalia.

ADEPS, U. S.—Lard.—The prepared internal fat of the abdomen of *Sus scrofa* (Class, *Mammalia*, Order, *Pachydermata*), purified by washing with water, melting, and straining. Lard should be preserved in securely-closed vessels, impervious to fat, and in a cool place. It is a soft, white, unctuous solid. It melts at 38° to 40° C. (100.4° to 104° F.) to a clear liquid, which is colorless in thin layers, which should not separate an aqueous layer, and at or below 30° C. (86° F.) it is a soft solid; sp. gr. about 0.932; faint odor, free from rancidity; bland taste; neutral reaction; entirely soluble in ether, benzin, and disulphide of carbon.

ADEPS BENZOINATUS, U. S.—Benzoinated Lard. (*Unguentum Benzoini*, *Pharm. 1870.*)—Benzoin 20 Gm., Lard 1000 Gm.

ADEPS LANÆ HYDROSUS, U. S.—Hydrous Wool-Fat.—The purified fat of the wool of the sheep, *Ovis aries*, *Linné* (Class, *Mammalia;* Order, *Ruminantia*), mixed with not more than 30 per cent. of water. A yellowish-white, or nearly white, ointment-like mass, having a faint, peculiar odor. Insoluble in water, but miscible with twice its weight of the latter without losing its ointment-like character. It melts at about 40° C. (104° F.).

OLEUM ADIPIS, U. S.—Lard Oil.—A fixed oil expressed from lard at a low temperature.

SEVUM, U. S.—Suet.—The internal fat of the abdomen of *Ovis aries* (sheep) (Class, *Mammalia;* Order, *Ruminantia*), purified by melting and straining. Suet should be kept in well-closed vessels impervious to fat. It should not be used after it has become rancid. It is a white, smooth, solid fat; nearly inodorous, gradually becoming rancid on exposure to air; bland taste, neutral reaction.

PANCREATINUM, U. S.—Pancreatin.—A mixture of the enzymes naturally existing in the pancreas of warm-blooded animals, usually obtained from the fresh pancreas of the hog, *Sus scrofa* (Class, *Mammalia;* Order, *Pachydermata*). A yellowish, yellowish-white, or grayish, amorphous powder, odorless, or having a faint, peculiar, not unpleasant odor, and a somewhat meat-like taste. Slowly and almost completely soluble in water, insoluble in alcohol.

Pancreatin digests albuminoids, and converts starch into sugar.

PEPSINUM, U. S.—Pepsin.—A proteolytic ferment or enzyme obtained from the glandular layer of fresh stomachs from healthy pigs, and capable of digesting not less than 3000 times its own weight of freshly coagulated and disintegrated egg albumen, when tested by the process given below. A fine, white, or yellowish-white, amorphous powder, or thin, pale yellow or yellowish, transparent or translucent grains or scales, free from any offensive odor, and having a mildly acidulous or slightly saline taste, usually followed by a suggestion of bitterness. Soluble, or for the most part soluble, in about 100 parts of water, with more or less opalescence; more soluble in water, acidulated with hydrochloric acid; insoluble in alcohol, ether, or chloroform.

VALUATION OF PEPSIN.—Prepare first the three following solutions:—

a. Water, 294 C.c.; HCl, 6 C.c. *b*. In 100 C.c. of A, dissolve 0.067 Gm. of the pepsin to be tested. *c*. To 95 C.c., sol. A, at 40° C. (104° F.) add 5 C.c. of sol. B. The resulting 100 C.c. of liquid will contain 0.2 C.c. (0.21 Gm.) of absolute HCl, 0.00335 Gm. of the pepsin to be tested, and 98 C.c. of water. Immerse an egg 15 m. in boiling water, remove, and place in cold water. When cold rub the albumen through a No. 30 sieve, reject the first portion, take 10 Gm. of the second cleaner portion, place it in a 200 C.c. flask; add ½ of sol. C., shake well, add the second ½ of sol. C., shake well, place in a water-bath or thermostat at 30° to 40° C. (100.4° to 104° F.) for 6 hours, shaking gently every 15 minutes. At the expiration of this time the albumen should have disappeared, leaving at most only a few thin, insoluble flakes.

The relative proteolytic power of pepsin stronger or weaker than that described above may be determined by ascertaining, through repeated trials, how much of sol. B made up to 100 C.c. with sol. A will be required exactly to dissolve 10 Gm. of coagulated and disintegrated albumen under the conditions given above.

PEPSINUM SACCHARATUM, U. S.—Saccharated Pepsin.—Pepsin, the digestive principle of the gastric juice, obtained from the mucous membrane of the stomach of the hog, and mixed with powdered sugar of milk.

Preparation.—Prof. Scheffer's Process: Macerate mucous membranes of hogs' stomachs in very dilute HCl, precipitate pepsin with NaCl, skim, drain, dry, and dilute with sugar of milk until 0.67 Gm. will dissolve 300 times its own weight coagulated albumen. Saccharated pepsin is a white powder; slight, but not disagreeable odor; slight, but not disagreeable taste. It is not completely soluble in water, leaving floccules of pepsin floating in the solution, which, however, dissolve on the addition of a small quantity of hydrochloric acid.

MOSCHUS, U. S.—Musk.—The dried secreti
follicles of *Moschus moschiferus* (Class, *Mammalia*
contains cholesterin, ammonia, and acid principl
and gelatinous principles, and an odorous matter n

Official Preparation.—Tinctura Moschi.

ACIDUM LACTICUM, U. S.—Lactic Acid.—An organic acid, usually obtained by subjecting milk sugar or grape sugar to lactic fermentation; composed of 75 per cent., by weight, of absolute lactic acid ($HC_3H_5O_3$; 89.79), and 25 per cent. of water.

Lactic acid is made from sour milk, cheese, meat juice, lactin, and from many vegetable products. Cane sugar is treated with sulphuric acid, so as to convert it into invert sugar, solution of caustic soda added, and the mixture heated until it ceases to precipitate Fehling's solution, showing the absence of sugar. Sulphuric acid is added, and the sodium sulphate formed is crystallized out, an addition of alcohol causing the precipitation of the remainder. The alcoholic liquid contains impure lactic acid; one-half of it is heated and zinc carbonate added until effervescence ceases; the other half of the alcoholic liquid is now added, and the whole allowed to cool. Zinc lactate crystallizes out; this, by treatment with hydrosulphuric acid, yields zinc sulphide, lactic acid remaining in solution. Acidum lacticum is a colorless syrupy liquid, absorbing moisture on exposure to damp air; sp. gr. 1.213; odorless; very acid taste; acid reaction; freely miscible with ether, but insoluble in chloroform, benzin, or carbon disulphide.

SACCHARUM LACTIS, U. S.—Sugar of Milk. $C_{12}H_{22}O_{11}.H_2O$; 359.16.—A peculiar, crystalline sugar obtained from the whey of cow's milk by evaporation and purified by recrystallization. It occurs in the form of white, hard, crystalline masses, yielding a white powder feeling gritty on the tongue, permanent in the air; odorless; faintly sweet taste; neutral reaction.

FEL BOVIS, U. S.—Ox Gall.—The fresh gall of *Bos taurus* (Class, *Mammalia;* Order, *Ruminantia*) contains *glycocholic acid*, $C_{26}H_{43}NO_6$; *taurocholic acid*, $C_{26}N_{45}NSO_7$; *hyoglycocholic acid*, $C_{27}H_{43}NO_5$; *hyotaurocholic acid*, $C_{27}H_{45}NSO_6$, and *chenotaurocholic acid*, $O_{29}H_{49}NSO_6$. A brownish-green or dark-green, somewhat viscid liquid, having a peculiar odor; a disagreeable, bitter taste, and a neutral or faintly alkaline reaction; sp. gr. 1.018–1.028.

FEL BOVIS PURIFICATUM, U. S.—Purified Ox Gall.—Fresh Ox Gall, 300 C.c.; Alcohol, 100 C.c. Evaporate the ox gall in a porcelain capsule, on a water-bath, to *one part*, then add to it the alcohol, agitate the mixture thoroughly, and let it stand, well covered, for twenty-four hours. Decant the clear solution, filter the remainder, and, having mixed the liquids and distilled off the alcohol, evaporate to a pilular consistence.

CETACEUM, U. S.—Spermaceti.—A peculiar, concrete, fatty substance, obtained from *Physeter macrocephalus* (Class, *Mammalia;* Order, *Cetacea*) contains *cetin*, *cetin elain*, which, when saponified, yield *cetin-elaic acid*, an acid resembling, but distinct from, oleic acid. The cetin is essentially *cetyl palmitate*, $C_{16}H_{33}(C_{16}H_{31}O_2)$. There are small amounts of fats containing *stearic acid*, $C_{18}H_{36}O_2$; *myristic acid*, $C_{14}H_{28}O$; and *lauro-stearic acid*, $C_{12}H_{24}O_2$, and the alcohol radicals corresponding to these acids.

Official Preparation.—Ceratum Cetacei.

Official Products of the Class Pisces.

ICHTHYOCOLLA, U. S.—Isinglass.—The swimming bladder of *Acipenser huso*, and of other species of *Acipenser* (Class, *Pisces;* Order, *Sturiones*).

Official Preparation.—Emplastrum Ichthyocollæ.

OLEUM MORRHUÆ, U. S.—Cod-liver Oil. (*Oleum Jecoris Aselli.*)—A fixed oil obtained from the fresh livers of *Gadus morrhua*, or of other species of *Gadus* (Class, *Pisces;* Order, *Teleostia;* Family, *Gadidæ*).

Preparation.—Heat the livers in a wooden tank by means of low-pressure steam, and drain off the oil. In the case of the finest varieties, the oil, which is made only in the winter months, is drawn off by taps from the bottom of the cooking tank, and then put into a cooling house to freeze. The solid frozen mass is put into canvas bags, and submitted, while at a low temperature, to severe pressure, whereby the pure oil is expressed. This constitutes the light oil of commerce. Cod-liver oil consists chiefly of olein, some palmitin, and stearin, with minute traces of iodine, chlorine, bromine, phosphorus, and sulphur. Oleum Morrhuæ is a colorless or pale-yellow, thin, oily liquid; sp. gr. 0.920–0.925; peculiar, slightly fishy, but not rancid odor; bland, slightly fishy taste; faintly acid reaction.

Official Products of the Class Aves.

VITELLUS, U. S.—Yolk of Egg.—The yolk of the egg of *Gallus Bankiva*, var. *domesticus* (Class, *Aves;* Order, *Gallinæ*), contains *vitellin*, a protein compound resembling casein, albumen, fat, cholesterin, inorganic salts, coloring matter, etc.; water 50 per cent. *White of egg* consists principally of albumen, with 80 per cent. of water. The inorganic salt present in largest proportion is potassium chloride.

Official Preparation.—Glyceritum Vitelli.

Official Products of the Class Insecta.

CANTHARIS, U. S.—Cantharides. (*Spanish Flies.*) *Cantharis vesicatoria* (Class, *Insecta;* Order, *Coleoptera.*)—Cantharides should be thoroughly dried at a temperature not exceeding 40° C. (104° F.), and kept in well-closed vessels. Cantharides owe their blistering properties to *cantharidin*, $C_{10}H_{12}O_4$, a white substance, in the form of crystalline scales, of a shining micaceous appearance; inodorous; tasteless.

Official Preparations.—Ceratum Cantharidis, Collodium Cantharide, Tinctura Cantharidis.

COCCUS, U. S.—Cochineal.—The dried female of *Coccus cacti* (Class, *Insecta;* Order, *Hemiptera*) owes its red color to carminic acid, $C_{17}H_{18}O_{10}$. It contains mucilage, fat, inorganic salts, etc.

CERA FLAVA, U. S.—Yellow Wax.—A peculiar, concrete substance, prepared by *Apis mellifica* (Class, *Insecta;* Order, *Hymenoptera*).

CERA ALBA, U. S.—White Wax.—Yellow wax bleached. A yellowish or brownish-yellow solid. It is brittle when cold, and when broken presents a dull, granular, not crystalline fracture, but becomes plastic by the heat of the hand. It melts at 63°–64° C. (145.4°–147.2° F.); sp. gr. 0.955–0.967; agreeable, honey-like odor; faint, balsamic taste. Beeswax is a mixture of three different substances, which may be separated from one another by alcohol, viz.: 1, *myricin*, insoluble in boiling alcohol, and consisting chiefly of myricil palmitate, $C_{30}H_{61}(C_{16}H_{31}O_2)$, which is a compound of *palmitic acid*, $C_{16}H_{32}O_2$, and *myricyl alcohol*, $C_{30}H_{62}O$; 2, *cerotic acid*, $C_{27}H_{54}O_2$ (formerly called *cerin* when obtained only in an impure state), which is dissolved by boiling alcohol, but crystallizes out on cooling; 3, *cerolein*, which remains dissolved in the cold alcoholic liquid. This latter is probably a mixture of fatty acids, as indicated by its acid reaction to litmus paper. (Remington.)

UNITED STATES COAST AND GEODETIC SURVEY.

By permission of T. C. MEN

TABLES FOR CONVERTING U. S. WEIGHTS

LINEAR.

	Inches to millimetres.	*Feet to metres.*	*Yards to metres.*	*Miles to kilometres.*
1 =	25.4000	0.304801	0.914402	1.60935
2 =	50.8001	0.609601	1.828804	3.21869
3 =	76.2001	0.914402	2.743205	4.82804
4 =	101.6002	1.219202	3.657607	6.43739
5 =	127.0002	1.524003	4.572009	8.04674
6 =	152.4003	1.828804	5.486411	9.65608
7 =	177.8003	2.133604	6.400813	11.26543
8 =	203.2004	2.438405	7.315215	12.87478
9 =	228.6004	2.743205	8.229616	14.48412

SQUARE.

	Square inches to square centimetres.	*Square feet to square decimetres.*	*Square yards to square metres.*	*Acres to hectares.*
1 =	6.452	9.290	0.836	0.4047
2 =	12.903	18.581	1.672	0.8094
3 =	19.355	27.871	2.508	1.2141
4 =	25.807	37.161	3.344	1.6187
5 =	32.258	46.452	4.181	2.0234
6 =	38.710	55.742	5.017	2.4281
7 =	45.161	65.032	5.853	2.8328
8 =	51.613	74.323	6.689	3.2375
9 =	58.065	83.613	7.525	3.6422

CUBIC.

	Cubic inches to cubic centimetres.	*Cubic feet to cubic metres.*	*Cubic yards to cubic metres.*	*Bushels to hectolitres.*
1 =	16.387	0.02832	0.765	0.35242
2 =	32.774	0.05663	1.529	0.70485
3 =	49.161	0.08495	2.294	1.05727
4 =	65.549	0.11327	3.058	1.40969
5 =	81.936	0.14158	3.823	1.76211
6 =	98.323	0.16990	4.587	2.11454
7 =	114.710	0.19822	5.352	2.46696
8 =	131.097	0.22654	6.116	2.81938
9 =	147.484	0.25485	6.881	3.17181

The only authorized material standard of customary length is the Troughton
standard. The yard in use in the United States is therefore equal to the British

The only authorized material standard of customary weight is the Troy pound
standard of mass. It was derived from the British standard Troy pound of 1758
latter, and contains 7000 grains Troy.

The grain Troy is therefore the same as the grain Avoirdupois, and the pound

The British gallon = 4.54346 litres.

The British bushel = 36.3477 litres.

OFFICE OF STANDARD WEIGHTS AND MEASURES.

DENHALL, Superintendent.

AND MEASURES—CUSTOMARY TO METRIC.

CAPACITY.

	Fluidrachms to millilitres to cubic centimetres.	*Fluidounces to millilitres.*	*Quarts to litres.*	*Gallons to litres.*
1 =	3.70	29.57	0.94636	3.78544
2 =	7.39	59.15	1.89272	7.57088
3 =	11.09	88.72	2.83908	11.35632
4 =	14.79	118.30	3.78544	15.14176
5 =	18.48	147.87	4.73180	18.92720
6 =	22.18	177.44	5.67816	22.71264
7 =	25.88	207.02	6.62452	26.49808
8 =	29.57	236.59	7.57088	30.28352
9 =	33.28	266.16	8.51724	34.06896

WEIGHT.

	Grains to milligrammes.	*Avoirdupois ounces to grammes.*	*Avoirdupois pounds to kilogrammes.*	*Troy ounces to grammes.*
1 =	64.7989	28.3495	0.45359	31.10348
2 =	129.5978	56.6991	0.90719	62.20696
3 =	194.3968	85.0486	1.36078	93.31044
4 =	259.1957	113.3981	1.81437	124.41392
5 =	323.9946	141.7476	2.26796	155.51740
6 =	388.7935	170.0972	2.72156	186.62089
7 =	453.5924	198.4467	3.17515	217.72437
8 =	518.3914	226.7962	3.62874	248.82785
9 =	583.1903	255.1457	4.08223	279.93133

1 chain = 20.1169 metres.
1 square mile = 259. hectares.
1 fathom = 1.829 metres.
1 nautical mile = 1853.27 metres.
1 foot = 0.304801 metre, 9.4840158 log.
1 avoir. pound = 453.5924277 grammes.
15432.35639 grains = 1 kilogram.

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scale belonging to this office, whose length at 59.62° Fahr. conforms to the British yard.

of the Mint. It is of brass of unknown density, and therefore not suitable for a by direct comparison. The British Avoirdupois pound was also derived from the

Avoirdupois in use in the United States is equal to the British pound Avoirdupois.

WASHINGTON, D. C., January, 1890.

UNITED STATES COAST AND GEODETIC SURVEY.

By Permission of T. C. MEN

TABLE FOR CONVERTING U. S. WEIGHTS

LINEAR.

	Metres to inches.	*Metres to feet.*	*Metres to yards.*	*Kilometres to miles.*
1 =	39.3700	3.28083	1.093611	0.62137
2 =	78.7400	6.56167	2.187222	1.24274
3 =	118.1100	9.84250	3.280833	1.86411
4 =	157.4800	13.12333	4.374444	2.48548
5 =	196.8500	16.40417	5.468056	3.10685
6 =	236.2200	19.68500	6.561667	3.72822
7 =	275.5900	22.96583	7.655278	4.34959
8 =	314.9600	26.24667	8.748889	4.97096
9 =	354.3300	29.52750	9.842500	5.59233

SQUARE.

	Square centimetres to square inches.	*Square metres to square feet.*	*Square metres to square yards.*	*Hectares to acres.*
1 =	0.1550	10.764	1.196	2.471
2 =	0.3100	21.528	2.392	4.942
3 =	0.4650	32.292	3.588	7.413
4 =	0.6200	43.055	4.784	9.884
5 =	0.7750	53.819	5.980	12.355
6 =	0.9300	64.583	7.176	14.826
7 =	1.0850	75.347	8.372	17.297
8 =	1.2400	86.111	9.568	19.768
9 =	1.3950	96.874	10.764	22.239

CUBIC.

	Cubic centimetres to cubic inches.	*Cubic decimetres to cubic inches.*	*Cubic metres to cubic feet.*	*Cubic metres to cubic yards.*
1 =	0.0610	61.023	35.314	1.308
2 =	0.1220	122.047	70.629	2.616
3 =	0.1831	183.070	105.943	3.924
4 =	0.2441	244.093	141.258	5.232
5 =	0.3051	305.117	176.572	6.540
6 =	0.3661	366.140	211.887	7.848
7 =	0.4272	427.163	247.201	9.156
8 =	0.4882	488.187	282.516	10.464
9 =	0.5492	549.210	317.830	11.771

By the concurrent action of the principal governments of the world an Inter
the direction of the International Committee, two ingots were cast of pure plati
From one of these a certain number of kilogrammes were prepared, from the other
tercompared, without preference, and certain ones were selected as International
ments, and are called National prototype standards. Those apportioned to the

The metric system was legalized in the United States in 1866.

The International Standard Metre is derived from the Metre des Archives,
platinum-iridium bar deposited at the International Bureau of Weights and Meas

The International Standard Kilogramme is a mass of platinum-iridium de
gramme des Archives.

The liter is equal to a cubic decimetre of water, and it is measured by the quan
ard kilogramme in a vacuum, the volume of such a quantity of water being, as

OFFICE OF STANDARD WEIGHTS AND MEASURES.

DENHALL, Superintendent.

AND MEASURES—METRIC TO CUSTOMARY.

CAPACITY.

	Millimetres or cubic centimetres to fluidrachms.	*Centilitres to fluidounces.*	*Litres to quarts.*	*Decalitres to gallons.*	*Hectolitres to bushels.*
1 =	0.27	0.338	1.0567	2.6417	2.8375
2 =	0.54	0.676	2.1134	5.2834	5.6750
3 =	0.81	1.014	3.1700	7.9251	8.5125
4 =	1.08	1.352	4.2267	10.5668	11.3500
5 =	1.35	1.691	5.2834	13.2085	14.1875
6 =	1.62	2.029	6.3401	15.8502	17.0250
7 =	1.89	2.368	7.3968	18.4919	19.8625
8 =	2.16	2.706	8.4534	21.1336	22.7000
9 =	2.43	3.043	9.5101	23.7753	25.5375

WEIGHT.

	Milligrammes to grains.	*Kilogrammes to grains.*	*Hectogrammes (100 grammes) to ounces Av.*	*Kilogrammes to pounds Avoirdupois.*
1 =	0.01543	15432.36	3.5274	2.20462
2 =	0.03086	30864.71	7.0548	4.40924
3 =	0.04630	46297.07	10.5822	6.61386
4 =	0.06173	61729.43	14.1096	8.81849
5 =	0.07716	77161.78	17.6370	11.02311
6 =	0.09259	92594.14	21.1644	13.22773
7 =	0.10803	108026.49	24.6918	15.43235
8 =	0.12346	123458.85	28.2192	17.63697
9 =	0.13889	138891.21	31.7466	19.84159

WEIGHT—(CONTINUED).

	Quintals to pounds Av.	*Milliers or tonnes to pounds Av.*	*Grammes to ounces, Troy.*
1 =	220.46	2204.6	0.03215
2 =	440.92	4409.2	0.06430
3 =	661.38	6613.8	0.09645
4 =	881.84	8818.4	0.12860
5 =	1102.30	11023.0	0.16075
6 =	1322.76	13227.6	0.19290
7 =	1543.22	15432.2	0.22505
8 =	1763.68	17636.8	0.25721
9 =	1984.14	19841.4	0.28936

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national Bureau of Weights and Measures has been established near Paris. Under num-iridium in the proportion of nine parts of the former to one of the latter metal. a definite number of metre bars. These standards of weight and length were in-prototype standards. The others were distributed by lot to the different govern-United States are in the keeping of this office.

and its length is defined by the distance between two lines at 0° Centigrade, on a ures.

posited at the same place, and its weight in vacuo is the same as that of the Kilo-

tity of distilled water which, at its maximum density, will counterpoise the stand-nearly as has been ascertained, equal to a cubic decimetre.

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Including the Sources, Methods of Preparation,
Tests, Solubilities, Incompatibles, Medicinal Properties and Doses as
far as known.

A REFERENCE MANUAL

FOR

Physicians, Pharmacists, and Students.

BY

VIRGIL COBLENTZ, A.M., Phil.D., F.C.S.,

Professor of Pharmacy and Pharmaceutical Chemistry in the New York College of Pharmacy; Author of "A Handbook of Pharmacy"; Member of the Chemical Societies of Berlin and London; Fellow of the Society of Chemical Industry, etc.

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